From the Edinburgh Review.

1. *Astronomical Observations made at the Royal Observatory, Greenwich, in the Year* 1847. Under the Direction of GEORGE BIDDELL AIRY, Esq., M. A., Astronomer Royal.
2. *Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the Year* 1847. Under the Direction of GEORGE BIDDELL AIRY, Esq., M. A., Astronomer Royal.
3. *Reduction of Observations of the Planets made at the Royal Observatory, Greenwich, from* 1750 *to* 1830. Computed by Order of the Lords Commissioners of the Treasury, under the Superintendence of GEORGE BIDDELL AIRY, Esq., M. A., Astronomer Royal. 4to. 1845.
4. *Reduction of Observations of the Moon, from* 1750 *to* 1830. By G. B. AIRY, Esq. 2 vols. 4to. 1848.
5. *Description de l' Observatoire Central de Poulkova.* Par F. G. W. STRUVE. St. Petersbourg, 1845. Fol.
6. *A Cycle of Celestial Objects observed, reduced, and discussed.* By Captain WM. HENRY SMYTH, R. N., &c. 2 vols. 8vo. 1844.
7. *Six Lectures on Astronomy, delivered at Meetings of the Friends of the Ipswich Museum.* By GEORGE BIDDELL AIRY, Esq., M. A., Astronomer Royal. 8vo. 1849.

No one has ever sailed down or up the Thames, and surveyed the stately domes and colonnades of Greenwich Hospital, without admiring the background which the wooded heights of Greenwich Park give to the landscape, and the contrasting architecture of the brick towers and minarets of the Royal Observatory, placed on a commanding height in the prolongation of the middle area of the hospital, and thus terminating the vista. But few of these voyagers, we suspect, take time to consider that the British navy owes an important part of its efficiency not less to the observatory than to the hospital—that humanity is interested in the former as well as in the latter—that the sovereign who foresaw the ultimate consequence to certain and safe navigation of a good system of astronomical observations, was in this instance as wise and patriotic as he who provided a magnificent asylum for the helpless old age of those who had already often owed the preservation of life to the patient vigils of the astronomer.

The fortunes of Greenwich Park have been as varied as those of most places the property of the crown in the vicinity of a capital. The manor of East Greenwich* was an unenclosed waste until the reign of Henry VI., when a charter conveying 200 acres of it was given to Humphry, Duke of Gloster, the king's uncle, and to Eleanor, his wife.

This curious charter (of which a copy is now before us) is dated 26th March, 1437.* Perhaps the foundations of Duke Humphry's tower still exist; at all events, it is certain that the observatory is built on the same site, being a position of no inconsiderable strength. It is a kind of peninsula jutting out towards the Thames from the general level of Blackheath and the southern district of the park, with which it is connected by a tolerably narrow isthmus, whilst the ground slopes rapidly in every other direction from the little table-land occupied by the observatory. The natural strength of the situation has evidently been increased by lofty retaining walls on the north, south, and west sides—sustaining both the building and a part of the pleasure ground.† This gives to the place an air of great seclusion and privacy, as well as apparent strength, not less suitable to its present than to its original destination—freedom from interruption and indiscreet curiosity being an inestimable advantage in an institution dedicated to such purposes in the midst of one of the most public resorts in the neighborhood of the metropolis. Mr. Francis Baily states,‡ on the authority of some MS. notes in a copy of Maskelyne's "Observations," that the tower was "repaired or rebuilt by Henry VIII. in 1526; that it was sometimes the habitation of the younger branches of the royal family, sometimes the residence of a favorite mistress, sometimes a prison, and sometimes a place of defence. Mary, fifth daughter of Edward IV., (betrothed to the King of Denmark,) died at the tower in Greenwich Park in 1482. Henry VIII. visited "a fayre lady whom he loved" here. In Queen Elizabeth's time it was called *Mirefleur*. In 1642, being then called Greenwich Castle, it was thought of so much consequence as a place of strength, that immediate steps were ordered to be taken for securing it. After the Restoration, Charles II., in 1675, pulled down the old tower, and founded on its site the present Royal Observatory." It should be noticed, that there was a distinct royal residence on the same manor, between

* Deptford was *West* Greenwich.

* Rot. Patent., 15 Hen. 6. M. 7. As a specimen of the quaint latinity, we quote the following permission:—"Muris petra et calce includere et firmare, et muros illos kernellare,[1] batellare, et turrellare, ac quandam Turrim infra Parcum prædictum similiter petra et calce de novo[2] construere, edificare, et tam turrim illam sic de novo constructam et edificatam quam dictum manerium sive mansionem ut præmittitur inclusum, firmatum, kernellatum, imbattelatum, et turrellatum, tenere possint sibi et hæredibus suis prædictis in perpetuum," &c. Copied from the original in the Tower.

† An accurate map of the grounds and buildings has been constructed and engraved by the present Astronomer Royal.

‡ Life of Flamsteed, p. 39, note.

1 *Kernellare*, from *créneaux* (Fr.) to make battlements for defence.

2 Hence it appears that there had been some still older structure.

Duke Humphry's tower and the river, called *The Pleasaunce*, which was frequented by Queen Elizabeth and other sovereigns.

Astronomy is a subject so palpable in its results, and conversant with facts so astounding yet so plain, that there is scarcely any age or period of the world in which most men have not, at some time or other of their lives, been drawn to it with a strong feeling of interest and awe. Perhaps some readers may be able to sympathize with our juvenile recollections of a time when the towers and walls of Greenwich Observatory seemed to us to enclose a profound yet tempting mystery, which we hardly dared hope ever to explore; or when we traversed the weary diameter of Paris to gaze on the observatory built by Cassini, and directed by Arago, or trod with respect the very stones of the *Rue du Bac*, at that time inhabited by Laplace. Considering that the practical details of observatories are witnessed by comparatively few persons, and that of those so privileged still fewer can pick up anything like an intelligent idea of what is going on, and how the astronomical paraphernalia they behold are made to yield a knowledge of the facts which they read of in books at home, we have thought that an attempt might be made to make this branch of knowledge accessible to all who have any acquaintance with its elements, and to reveal some of the mysteries of the art and practice of an astronomical observer, to many who may never think of becoming either profound astronomers or practised observers themselves.

We propose, therefore, in the present article to consider, *first*, what it is which the practical astronomer professes to determine; *secondly*, to notice the instruments which he uses in order to make these determinations; and, *thirdly*, to attempt a sketch of the economy and management of an observatory, its *personnel*, as well as its *matériel*—which we shall illustrate by a more especial reference to the National Observatory of Greenwich. The two first heads we will make as brief as may serve to a due understanding of our third and principal topic.

I. Practical astronomy has two great branches. That to which the telescope may be said to have given birth; and that which is *comparatively* independent of it. Before the invention of the telescope, Copernicus had announced the true system of the world—namely, that the sun is the centre of a planetary system, of which the earth is one member, with the moon circulating round it; and that the fixed stars are altogether independent and placed at a vastly greater distance. The periods and comparative distances of all the principal planets were known; as well as the deviation of the orbits of some of them from a circle; and a certain approximation was made to the singularly irregular form of the lunar path; eclipses could be calculated with tolerable accuracy; latitudes and longitudes roughly ascertained; and even such delicate phenomena as the apparent displacement of the heavenly bodies by refraction, and the general excessively slow motion of the fixed stars relatively to a point altogether imaginary, termed the *equinoctial point*, had been clearly discovered and imperfectly measured.

But when the telescope gave to man almost a new sense, and enabled him to examine objects at a distance, with the advantage of a vast magnifying power, a new department of practical astronomy arose. Astronomers had hitherto only seen the rude outline of our own system, and the still ruder landmarks of the starry firmament. The telescope not only revealed thousands, nay millions of bodies, hitherto unseen because invisible, but it displayed complications of arrangement and feature, which gave, as it were, a *coloring* to the broad natural outlines with which hitherto the astronomer had to content himself. The moons of Jupiter and Saturn, the rings of the latter, and the varying phases of Venus and Mercury were, of course, among the first points of telescopic vision—and a glorious insight they gave into the arrangements of our system. Then the actual physiognomy of the moon, the sun, and some of the nearer planets, after which the unaided eye could only vainly strain itself, and desire for more help, opened fresh fields of inquiry. More lately, the indefatigable study of the fixed stars and nebulæ—with the aid of powerful instruments, and especially by the two Herschels—has enlarged so prodigiously the boundaries of our knowledge and of rational and interesting speculation, that it is impossible to overrate the charms of this branch of practical astronomy. It has, however, been so fully considered in a recent article* on Sir John Herschel's "Observations at the Cape of Good Hope," that we gladly abstain from further notice of it at present; desiring to concentrate the reader's attention on the department of practical astronomy cultivated alike by the ancients and moderns before and since the invention of the telescope, and which consists in the *measurement of space* with reference to the places of the heavenly bodies, and the comparison of those places with theory.

Whoever would record the positions of the heavenly bodies at any moment, and compare them (as regards their apparent movements relatively to one another) at some future time, must do so by referring them to certain lines or directions, which may be regarded as fixed and known.

The easiest reference is found by a comparison with that which is familiarly used to determine the position of places on the surface of the earth, or latitude and longitude. Though the terrestrial and celestial globes are not only different in their delineations (as a certain lady of fashion is said to have discovered, when she returned her globes to the maker because they were not *a pair*,) but also in their *idea* or principle, the apparent place of a star on the celestial sphere may be defined by two angles, called declination and right ascension, corresponding accurately to those of latitude and longitude, which determine the spot on the surface of the earth occupied (for example) by

* Ed. Rev., vol. lxxxviii., p. 104.

New York or Mount Blanc. Whirl a globe round its axis, and a pencil approached to the surface will touch all places having the same latitude—all stars having the same declination. Stretch a thread tightly from pole to pole, and it will meet the position of all places on the surface having a common longitude, and (on the celestial globe) of all stars having the same right ascension. The pencil mark will meet the thread but in one point; thus the place is fixed completely by two angles, measured each from the centre of the globe along those circles;—the *zero point* of reference for right ascension being determined by a particular point called the vernal equinox, or the first point of Aries: whilst on the terrestrial globe the longitudes are measured from the meridian of Greenwich.

If we imagine the eye placed in the centre of a celestial globe, and the fictitious stars to be each pierced with holes through its surface, that eye would, if the globe were properly turned, see each star in the heavens through its appropriate hole. Such, in fact, is all the information which a celestial globe is intended to convey—the idea of direction, or apparent place—not at all that of distance. The moving lights of heaven—sun and moon, planets and comets—change, from day to day and from hour to hour, their seeming place. To be able to define accurately their apparent place at a given instant, is the first aim of the practical astronomer. This is done by ascertaining their declinations and right ascensions—the former being the apparent angular distance of a star from the celestial equator; the latter, the angle formed by the meridian (or line traced by the thread stretched from pole to pole and touching its place) with some other meridian, drawn arbitrarily or otherwise among the stars; just as in geography we, in Britain, refer the longitude of places to that of Greenwich. The astronomer, having traced the motions of an erratic star or planet on the apparent surface of the sphere, possesses the data for testing the truth of astronomical theories, whether of merely *formal* theories like those of epicycles and deferents, (as they were called,) or of *physical* theories like those of vortices and of gravitation. The apparent complication of these movements is in nature exceedingly great; consequently, the coincidence of *observed* with *predicted* places is the best test of theories; and thus the perfection of our observations becomes essential for the establishment of theories, especially of that greatest of physical laws hitherto detected by man—the law of gravitation.

But the power of tracing with accuracy the places of the heavenly bodies on the apparent vault of the sky, and therefore with reference to one another, carries us a step further, even to the measurement of the impassable and seemingly illimitable spaces which divide them from us. We cannot indeed apply a rod or chain to measure the moon's distance, but we may do as those surveyors did who measured the height of Mont Blanc ere it had been ascended. Our earth, to be sure, is very small, compared with the spaces which separate from us even the nearest of the heavenly bodies, and a mere mathematical point as compared to the distances of the fixed stars. It is, however, so large that the moon, for instance, is very visibly displaced as we regard her from one part of the earth or another. The direction of the earth's axis is a perfectly well ascertained line. If we look in its direction from any part of the earth's surface, the whole firmament appears to revolve round it by the diurnal movement; in this direction, then, a telescope may be accurately pointed. Let this telescope next be turned on the moon:—the angle which the telescope describes may be called the moon's north or south polar distance. If this experiment were performed *simultaneously* at Greenwich and at the Cape of Good Hope, the moon would appear further *north* from the latter than from the former station; for the same reason that if we go from the lower to the upper window of a house, the neighboring chimney, which in the former case seemed to touch the distant weathercock, now falls far beneath it. Thus, also, the moon, when she passes centrically over a fixed star, as viewed by a spectator near the equator, will leave it uneclipsed to an astronomer in the Artic or Antartic seas, passing to the south of it in the one case, and to the north in the other. This seeming displacement is called *parallax*. The greatest amount of parallax which the moon could possibly have, would be, if we imagine a spectator placed at either pole of the earth. The displacement to each, compared to the moon's position as seen from the earth's centre, would be about a degree, or the whole angle under which the earth's diameter (8000 miles) is seen at the moon, is two degrees.

In the same manner the parallax of the planet Mars and the planet Venus, when nearest to the earth—and even the distance of the sun—may be ascertained by observations made, *under favorable circumstances*, at different parts of the earth's surface; and since we are personally confined, by a physical necessity, to the surface of our globe, we can only make the best of the limits of voluntary excursion which Nature and Providence have assigned to us.

But though our voluntary peregrinations be confined to narrow limits—although our globe is but a speck in space, and although a voyage from pole to pole would be, by the shortest route, but some paltry 12,000 miles—fortunately for astronomy, we make an annual tour in the course of our orbital revolution round the sun, which carries us to two points of space nearly 200 millions of English miles apart. Seated on this comfortable railway carriage called the globe, we are actually tearing through space at the rate of nineteen miles *per second*, or 67,000 miles an hour; and the distance and position of the sun being known at any time by observation, the actual distance between the points of space occupied by us, the travelling spectators, on any two days, is accurately known. For instance, on the longest and on the shortest day, our positions are, as we have said, nearly 200,000,000

miles apart. Of course this annual trip makes a vast change in the celestial scenery of the bodies nearest to us. The other planets, if they did not move themselves, would appear to do so by our own relative motion;—as it is, they have apparent movements, resulting from *their own*, as well as from our earth's orbital motions. But the most extraordinary fact is this; that, notwithstanding the vast space which separates the position of our earth at opposite seasons of the year, the scenery of the fixed stars is noways sensibly distorted by our change of place. The vast distance from the earth to the sun is seen from the nearest fixed star under an angle probably not exceeding *one second* —which is about *one two-thousandth* of that which the sun's or the moon's disc subtends! This is called the *annual parallax;* and, admitting it to exist, the nearest fixed star must be 206,000 times more distant from the sun than our earth is; or 5,000,000,000 diameters of our globe, or about *twenty billions* of English miles!

Thus our knowledge of the distance of the fixed stars (the greatest to which the art of mensuration has yet extended) depends upon the diameter of the earth's orbit; which, again, is deduced from a triangle having the earth's diameter for one of its sides. But how is this last quantity determined?

The measurement of the earth was one of the most justly celebrated problems of antiquity. The science of *geometry* owes its name to this single application. We must refer to previous papers in this Journal* for its history and solution. But we may observe that the fertile principle of triangulation is here, again, the basis of operation. At first, extensive though rude measurements of considerable spaces of the earth's surface were attempted. Norwood, about 1635, *guessed*, rather than ascertained, the distance from London to York, by measuring with a chain along the highway, allowing for its bends and obliquities, and sometimes merely by pacing. But the ingenious Snell made a better determination, by ascertaining a comparatively short distance by means of *exact* measurement†, and extending that measure, by a series of connected triangles, to a comparatively large portion of the meridian—a process improved, in later times, by measuring a *second* base line near the close of the operation, and comparing it with the result of calculation carried forwards through the whole intermediate network of triangles. A coincidence of the calculated and observed results gives the very highest probability to the accuracy of the whole operation. From such an extended arc of the meridian the dimension of the whole globe is inferred, by reasoning which we cannot stop here to explain, but which in the simple case of the earth, being supposed truly spherical, is exceedingly easy and direct.

Now on these processes we have two remarks to make. *First*, that the operations of practical astronomy, as far as they regard the fixation of the distances and positions of the heavenly bodies, depend upon one single fundamental measurement of space, just as in surveying land with a Theodolite;—that measurement being the single measured side of the network of triangles which (rigorously speaking) is all that is required to measure an arc of the meridian, and consequently the axial diameter of our globe. Any error in that single fundamental linear measure is *proportionally transmitted* through all the succeeding calculations. The rod used in measuring a base line is commonly somewhere about ten feet long; and the astronomer may be said truly to apply *that very rod* to mete the distance of the stars! An error in placing a fine dot which fixes the length of the rod, amounting to *one five-thousandth* of an inch, (the thickness of a single silken fibre,) will amount to an error of 70 feet on the earth's diameter, of 316 miles on the sun's distance, and to 65,200,000 miles on that of the nearest fixed star! The *second* point to which we would advert is, that as the astronomer in his observatory has nothing further to do with ascertaining *lengths* as distances, (except by calculation,) his whole skill and artifice are exhausted in the measurement of *angles;* for it is by these alone that spaces inaccessible can be compared. *Happily, a ray of light is straight;* were it not so, (in celestial spaces at least,) there were an end of our astronomy. If we may be permitted a pleasantry on such a subject, it is our *beam* compass, and it is inflexible as adamant—which our instruments for ascertaining its position unfortunately are not. Now an angle of *a second* (3600 to a degree) is a subtle thing. It is an apparent breadth utterly invisible to the unassisted eye, unless accompanied with so intense a splendor (as in the case of the fixed stars) as actually to raise by its effect on the nerve of sight a spurious image having a sensible breadth. A silk-worm's fibre, such as we have mentioned above, subtends an angle of a second, at $3\frac{1}{2}$ feet distance; a cricket ball $2\frac{1}{2}$ inches diameter must be removed, in order to subtend a second, to 43,000 feet, or about 8 miles—where it would be utterly invisible to the sharpest sight, aided even by a telescope of some power. Yet it is on the measure of one single second that the ascertainment of a sensible parallax in any fixed star depends; and an error of $\frac{1}{100}$ of that amount (a quantity still unmeasurable by the most perfect of our instruments) would place the star too far or too near by 200,000,000,000 miles—a space which light requires 118 days to travel.

The practical astronomer is not, however, constantly or principally employed in directly measuring the distances of the heavenly bodies, or the dimensions of the earth. The earth's diameter is now known with very great exactness, and the distance of the sun cannot become much better known, at least until the recurrence of the rare phenomenon called the transit of Venus. But

* Ed. Rev., vol. v., p. 372; vol. ix., p. 373; vol. lxxvii., p. 392.

† *Eratosthenes Batavus*, 1617. The measured base on which Snell ultimately depended was only 87 perches, (of 12 Rhineland feet each,) or about 1080 English feet. (Delambre, "Hist. d'Astron. Moderne," ii. 97.)

the astronomer is engaged in ascertaining from time to time, with the utmost accuracy, the positions of the so-called *fixed* stars, (which have *all* however, without exception, some small apparent motions,) because these are the true landmarks of the heavens, to which the positions of all other bodies, sun, moon, and planets, are constantly referred;—and likewise in comparing the positions of those moving bodies, from time to time, with tables, constructed from the best existing theories of their motions, in order that such theories may be improved. The great usefulness of such improved theories will be seen in the course of the following pages.

II. We now proceed to give a general idea of the instruments used for ascertaining the position of a heavenly body in the sky, by means of the angles of Right Ascension and Declination, of which we have already spoken.

The ancients reckoned the right ascension of the heavenly bodies from that of a certain bright star in the constellation called *Aries*, which star nearly coincided with the position of the sun at the equinox of spring. There is at present no star in that place; yet astronomers know how to find the equinoctial points (as they are called) in the sky, and to reckon right ascensions from them, just as we count longitudes on the earth's surface from the meridian of Greenwich.

Imagine a straight and perfectly vertical wall built truly north and south, or in a plane coinciding with the earth's axis. A spectator looking carefully along one side of such a wall would observe at the same instant all celestial bodies, having the same right ascension, to pass out of sight behind the edge of the wall, (in consequence of the apparent diurnal motion of the heavens,) supposing that he looked along the eastern side; or to start simultaneously into view if he watched them at the western side. Their apparent passage across the plane of the wall may be called their *transit across the meridian*. Each successive hour, nay, almost every minute, will bring some new object to the same position of passing the meridian; and since the diurnal motion of the stars is *absolutely* uniform, the intervals of their passages, measured by a good clock, will give a proportional measure of the angles between the meridians belonging to each object respectively. In fact, whether the clock go true or not, provided only that it go *regularly*, we have but to observe the interval of time between the passage of a star across the meridian and its return to it again; and considering that in that time the heavens must have made an entire revolution of 360°, we may by the rule of three find the angle corresponding to the intermediate place of any star whose time of transit by the clock has been noted. The entire period of revolution of the heavens from a star passing the meridian to its return, is called a *sidereal day;* one twenty fourth of this is a sidereal hour, and so forth.

Now, if, instead of merely *looking along* the side of a wall—an operation whose accuracy is comparable to that of observing the sun's shadow formed by the *style* of a common dial, and which is evidently the same in principle—we use a telescope with cross wires in its focus, and which is compelled to move always against this wall, we have a better kind of observation. If this telescope further carry with it an index which points to the angles of elevation, to which it is pointed at the instant that the star passes the meridian, the angles being drawn or engraved upon an arc of the quadrant, measuring degrees with the vertical, we ascertain the two determining angles or *coördinates* at the same moment; that measured by the time of the meridian passage or transit giving the *Right Ascension*, and the angle with the vertical, (to which, when a certain angle is added, we have the angle with the direction of the earth's axis,) giving the *North Polar Distance*. This method was due to Römer, or possibly to Römer and Picard jointly, and was practised by Flamsteed for thirty years, from 1689 till his death.

A method in some respects preferable consists in using two separate instruments for these determinations. At all events a good Transit Instrument (as it is called) cannot be made without allowing the telescope, which is to move strictly in the plane of the meridian, to be secured to a horizontal axis firmly sustained at both ends; and when this is done, *the meridian wall which we have supposed may be entirely dispensed with*. The transit instrument, the simplest and most effective of all astronomical apparatus, was the invention of Römer, an eminent Danish astronomer, about the year 1690.* It was introduced at Greenwich by Halley, the second astronomer royal, in 1721, but was evidently but little known in England some years later, being described by the visitors of the Royal Observatory, in 1726, as "a curious telescopic instrument."† Dr. Pound had, however, used one previously, which was probably the earliest in England. Halley's instrument is still preserved at Greenwich—5 feet long, $1\frac{3}{4}$ inches aperture. The telescope is not attached at the middle point of the axis, an arrangement not easily to be accounted for. The transit instrument has three adjustments for placing it correctly in the meridian; but for an account of these we must refer to more special treatises. In modern instruments five or seven vertical and equidistant wires are placed in the field of view, so that the apparent passage of the star across all may be noted, and the average taken.

The clock, one of the greatest of modern inventions, is the invariable and most essential companion of the transit instrument. The invention of the pendulum clock is somewhat obscure; but

* Horrebowii Opera, iii. 48.

† "Rigaud's Life of Bradley," p. lxxii. A learned friend has remarked to us that "curious," in the scientific language of the day, meant "accurate and delicate;" which is no doubt true. But we are entitled to infer that had the transit instrument been familiarly known at that time it would have been referred to by its own name. It was described as "curious," because it was really more accurate than the instruments then in common use.

in the hands of Huygens and Hooke it first became practical, and this was only about the year 1657, or eighteen years before the foundation of Greenwich Observatory, (August 10, 1675.) The earliest English pendulum clocks (after those of Hooke) were probably by Tompion. Flamsteed had two —with pendulums thirteen feet long, (beating two seconds,) and they were wound up but once a year. He did not regard an error of ten seconds in the determination of time as excessive;* and when his clocks were out of order they would err as much as eleven minutes per day.† In Halley's time they were not much better. They had no provision for going during the time of winding; and the bob often struck the sides of the case, and thus altered the rate! A *journeyman clock*, to take seconds from the principal clock, having a loud beat, and probably striking a bell at the full minute, appears to have been used by Römer. But Graham, one of the most eminent of British artists, subsequently brought his timekeepers almost to a level, in point of performance, with those of the most recent times, as the clock rates in Bradley's time (1750) clearly show.‡

For measuring altitudes (and hence polar distances) a divided brass arch of ninety degrees (or a quarter of a circle) has been in almost immemorial use. But though it may appear sufficient in theory for measuring all angles between the horizon and zenith, it is found to be practically much better to employ complete circles, divided from 0° to 360°; whereby many errors arising from the imperfect division, the inaccurate centering, the flexure and the deterioration by use, of the instrument, are avoided. Circular instruments are most commonly confined to the meridian, the circle itself (like a wheel with spokes) turning along with the telescope, and its position being ascertained by six equidistant microscopes, used for noting the divisions engraved on the circle; they are fixed to the solid wall or pier, with which the circle is connected by a horizontal axis passing through the pier.

The *zenith sector*, as usually constructed, is merely a telescope of considerable length connected with an arc to which the movement of the telescope, carrying cross wires, may be referred for measuring the zenith distances of stars when that angle does not surpass a few degrees. Such a construction admits of the use of very long telescopes and proportionally large divisions on the *limb* or arch, which, being exceedingly short, is not thereby rendered unwieldy. It was by the use of such an instrument that Bradley made his celebrated discoveries of aberration and mutation. It is likewise an effective instrument for taking latitudes in trigonometrical surveys.

Altitude and azimuth circles are those which admit, by their construction, of taking elevations or zenith distances, not only in the meridian, but in any other vertical plane, whose inclination with the meridian or azimuth they likewise determine. They have advantages, especially as portable instruments, and where a consecutive series of observations in one spot, and for a lengthened time, is intended; they have likewise the important advantage of *reversion*, or the capacity of being used on the meridian with the face alternately east and west. But, on the whole, such instruments have been little employed in fixed observatories; partly from the difficulties of construction when the dimensions are very great, and partly from the labor of calculation indispensable for deducing the true place of a heavenly body from such observations. There have, however, been three great exceptions, in which excellent work has been done with the altitude and azimuth circle:—the five-feet circle at Palermo, made by Ramsden, and used by Piazzi for his catalogue of the stars; the eight-feet circle at Dublin (planned by the same maker) employed by Brinkley in ascertaining the small apparent motions of the fixed stars; and the recently-constructed altitude and azimuth circle used by Mr. Airy, at Greenwich, for observing the moon, as we shall presently mention.

The various instruments we have now described all require peculiar *adjustments* before they can be applied to any useful purpose. The transit instrument, and the circle or zenith sector must be capable, for instance, of being placed accurately in the meridian, and the telescope accurately adjusted to the zenith point, before right ascensions can be obtained by means of the one, or polar distances by the other. The limits and popular nature of this article forbid any attempt to enter into these important *minutiæ;* but the reader may find them very plainly and clearly expounded in Sir John Herschel's excellent elementary treatises on astronomy.* We will only remark here, that the verification of the transit instrument is the more easy and simple; the determination of zenith points less direct, especially in instruments like the mural circle, which are incapable of being turned round so that the face of the instrument may be either *east* or *west* whilst the telescope is directed to an object on the meridian. But circles fixed to walls cannot be so used;† and the zenith and horizontal points are then very ingeniously determined, by observing a star alternately by direct vision through

* Baily's Flamsteed, p. 45.

† Ib., p. 114.

‡ See "Bessel Fundam. Astron." p. 91. Bradley's clock was made by Skelton, Graham's pupil.

* Some excellent practical information in a popular form may also be obtained from Captain Smyth's "Celestial Cycle."

† Bradley determined his zenith point by shifting his sector bodily from an east to a west wall; and this method was practised at Greenwich down to the time of Maskelyne; and the result was used for finding the index error of the quadrants. Bradley's skill is shown by the accuracy of his determination of the latitude of Greenwich when compared with the most recent results:—

	Latitude Greenwich.
Bradley, from his annual observations, . .	51° 28′ 39½″
Bessel, from Bradley's obs., ...	51 28 39.6
Maskelyne ("Requisite Tables," 1802, p. 199,)	51 28 40.0
Pond, ...	51 28 39.0
Airy, from 5862 obs., ...	51 28 38.2

Flamsteed, in 1676, made it 51° 28′ 10″ by his sextant; but in 1690, 51° 28′ 34″ by the mural arc.—(Baily, p. 346.)

the telescope, and then as its image appears reflected from a basin of quicksilver. By a simple optical law the position of the telescope, exactly intermediate between the two observations, is the horizontal position.

But the north polar distance of a body may be inferred independently of a knowledge of the zenith point. The instrument called the Equatorial telescope is arranged with this view. This telescope is attached to a firm axis or shaft parallel to the earth's axis—so that, as it revolves, the telescope follows the natural diurnal course of the stars. The *polar axis*, as it is called, is now generally connected with a piece of clock-work (of a peculiar construction, somewhat resembling that of a common *jack*, and without a pendulum; so that the motion takes place without jerks or starts of any kind,*) which causes the telescope to follow, spontaneously as it were, the motion of the object, and thus keep it always in the field. The right ascension is shown by an index connected with the polar axis, and pointing to an hour circle; the north polar distance by an index connected with the telescope itself. Owing to the inevitable tendency to flexure of the oblique-lying polar axis, and the intricacy of the adjustments, the equatorial construction is never used for determining with *extreme* accuracy the places of celestial objects; but it is still most useful—*first*, for ascertaining the places of comets and other erratic bodies which cannot always be seen on the meridian (and by comparing their transits across the wires of the telescope, in *any* fixed position, with that of known stars, their places may be very accurately estimated;) and, *secondly*, for mounting powerful but unwieldly telescopes, when the divided circles become the readiest means of pointing such telescopes to given objects. The largest refractor in the world—that at Pulkowa, near St. Petersburg, made by Merz and Mähler, 14.93 inches aperture—is thus mounted, so are the great refractor of the Washington National Observatory, U. S., and the Northumberland Telescope, at Cambridge. Mr. Lassell, of Liverpool, has been successful in mounting a ponderous reflecting telescope, of two feet aperture, in the same way.†

III. Such, very briefly, are the principal instrumental means of making astronomical observations. We shall now say something of observatories and their arrangement; taking the National Observatory of Greenwich as our chief example, because one of the most extensive and most systematic in the world, the most important in its *past* results to astronomical science, and because naturally the most interesting to our readers.

Observatories were originally little else than what their Latin name (*specula*) imports—look-out towers raised above surrounding objects and low vapors. Galileo showed the satellites of Jupiter from the lofty campanile at Venice; and all the early observatories were built somewhat on the same plan. That of Copenhagen, for instance, (founded in 1632,) was 115 Danish feet in height, and 48 feet in diameter; a stair, or rather a spiral passage, led to the top, so that, as at Venice, it could be mounted on horseback, which the Czar Peter really did, and the Empress Catherine in a six-horse coach! But far graver inconveniences than trees or fogs attended these lofty towers. The Danish astronomer, Römer, was so persecuted by the wind that he was glad to shelter his really useful instruments in his own house, where his principal observations were made. Finally, the observatory having taken fire, the whole of the valuable manuscripts were destroyed in consequence of the inaccessibility of the building.

Römer was, perhaps, the most original and ingenious astronomer of his day. He was the discoverer of the progressive motion of light, and the undoubted inventor of the transit instrument. But, besides this, he designed and executed the first meridian circle with fixed microscopes, on a plan which appears almost unexceptionable, and which anticipated the ultimate progress of practical astronomy by more than a century. He also placed a transit instrument at right angles to the meridian, for the purpose of determining declinations as well as right ascensions by the use of the clock—a method, the beauty and value of which are only now beginning to be appreciated. Römer's little "Tusculan," or rural observatory, as described by his pupil Horrebow,* is admirably contrived, with little show; and it was here that he made that three days' course of observations (*Triduum Roemeri*) 20—23rd Oct., 1706, which, owing to the fire already mentioned, has descended to us as almost the only relic of his observatory work. It consists of determinations of the places of the sun, moon, planets, and eighty-five fixed stars, and is truly, as Delambre has described it,† "a work worthy to serve as a model." The right ascensions were observed with all three wires of the transit instrument—a precaution often neglected even by Bradley fifty years later. The piers of the instrument were blocks of fir wood, the axes were hollow cones of iron. We may here note, that observatories like that of Römer, of small pretension, and in by no means favorable situations, have often produced greater results than national establishments, furnished at a lavish expense, but for ostentation rather than use; or, at least, abandoned to the care of indolent or mercenary guardians. Thus Catherine II. ordered for the observatory of St. Petersburgh the finest and most expensive instruments which London artists (then the first in the world) could produce; but having done so, and filled the journals with announcements of her liberality and love of science, they were allowed to rust

* The Equatorial at Liverpool is moved by *water power*, the velocity being uniformly maintained by Sieman's ingenious regulator. In the more usual construction of equatorial clocks, the friction of balls replaces the retarding action of the air's resistance in the common jack.

† Flamsteed's sextant was mounted with a polar axis merely for the convenience of directing it to the heavens. (See engraving in "Historia Celestis," vol. iii.) Römer constructed a well-devised equatorial instrument (under that name) in 1690. See Horrebow, *Opera*, iii. 39.

* Opera, tom. iii., cap. xvi.

* Hist. Astron. Moderne, ii. 655.

in their cases!* On the other hand, small private observatories, like Mr. Lassell's at Liverpool, (in one of the worst climates in Britain,) and Mr. Bishop's at the Regent's Park, directed by the zeal of Mr. Hind—not to mention Sir William and Sir John Herschel's—have produced some of the most interesting, and, at the same time, most optically difficult modern discoveries. Captain Smyth's observatory, described in his "Cycle of Celestial Objects," deserves mention as an excellent model for a simple private establishment, and his work as a useful guide to the amateur. "A man may prove a good astronomer," says Captain Smyth, "without possessing a spacious observatory. Thus Kepler was wont to observe on the bridge at Prague; Schoeter studied the moon, and Harding found a planet from a *gloriette;* while Olbers discovered two new planets from an attic of his house."

The observatories of Paris, Milan, Bologna, and indeed of Greenwich itself, attest the formerly universal practice of giving to these edifices the form of a lofty tower with a flat roof.

The introduction of *fixed* instruments—that is, of instruments that rest upon piers, (like a transit,) or are attached to stone walls, (like a mural quadrant or circle,)—necessitated a very different construction; and the principally effective part of most modern observatories consists of a range of rather low buildings running east and west, so as to contain but one chamber in breadth from north to south. Thus each apartment, having a slit in the roof and two walls, may command the zenith, and the north and south horizon. Revolving domes containing a slit, for the shelter of equatorial telescopes, are often raised up to the second floor, the instrument resting upon a very solid pillar of masonry carried up from the ground.

A foundation of sand, clay, or gravel, has usually been preferred to solid rock, which is supposed to convey injurious tremors more readily to the instruments. The Edinburgh Observatory, however, which is built on a rock, through which there passes at no great distance a railway tunnel, is stated by Professor Smyth to be in no way injured by this seemingly untoward circumstance.

The National Observatory of Russia, at Pulkowa, about twelve English miles from St. Petersburg, is probably the most elaborately complete modern observatory, having been erected, with the usual liberality of the emperor, at a cost of no less than 2,100,000 paper roubles, or about 80,000*l.* sterling,† and endowed with a revenue of 2,500*l.* a year.

It consists of a great central building, nearly in the form of a cross, composing the observatory proper, with apartments for observation and computation. It is surmounted by a noble dome, which contains the Great Refractor—the triumph of the Munich workshops. The special aim of this observatory is Sidereal Astronomy. A smaller dome surmounts the east and west arms of the cross. Two extensive wings, containing the habitations and offices of the entire personal establishment, extend the imposing frontage, which is in the Grecian style, to more than 800 feet. It is the noblest edifice ever yet erected to the purposes of science. The personal establishment, under the able direction of M. Struve, includes fourteen, besides servants and ordinary workmen, and the families of all. The total number of inmates in 1844 was 103.* A most admirable scientific library, collected at a great expense, forms part of the outfit, of which an excellent and useful catalogue is to be found in the description of the observatory mentioned at the head of this article, and to which we must refer for further details, into which, unfortunately, our limits do not allow us to enter. Russia may indeed be justly proud of her Temple to Urania, and of the fame of Struve, her astronomer; yet, when we compare all this splendor with the humbler practical establishment of Greenwich, we feel that there is an amount of mere luxury in buildings, in instruments, in the unstinted supplies of an imperial treasury, which threatens, under a less energetic chief, to seduce men from the full performance of a most toilsome duty. Pulkowa is like the palace of an astronomical autocrat, who has but to *will*, and men and money appear at his call to take the heavens by storm. Greenwich resembles the counting-houses of some of our opulent city merchants, showing more brick than marble, but whose cellars are stored with the accumulated wealth of generations.

The general position of Greenwich Observatory has been already described. The building consists of two very distinct parts; the *Old* Observatory having the usual tower form, (in this case octagonal from the first floor,) surmounted by a flat roof, from which rise two small turrets; and this central tower is flanked by two wings, also of brick, and now capped with two small, revolving domes. This edifice, which is conspicuous in every view of the observatory, faces the river Thames, coming forward to the very brow of the hill which it occupies. With the exception of the two small domes, it is *nearly* in the state in which it was constructed from Sir Christopher Wren's plan. Contiguous to it, on the south, is the dwelling-house of the Astronomer Royal, which has received several successive additions. The *New* Observatory dates, in its greater part, about a century back, and lies quite detached, and to the S. W. of the former building. It is comparatively low and unconspicuous. It is chiefly composed of a range of apartments running from west to east. There is a small revolving dome on the second floor near either end. The humble exterior of this, the really working observatory, will probably astonish any person who expects to view a great national edifice celebrated for the

* Delambre, Hist. Astron. Moderne, p. 620.

† This includes 12,000*l.* for the cost of instruments entirely furnished from Germany.

* "Description de l'Observatoire de Poulkova," p. 54. The fourteen persons mentioned above include secretary, mechanist, pupils, &c.

quantity and excellence of observations, of the most delicate kind, which have been made in it.

Charles II. founded Greenwich Observatory. It was the natural result of the tendency of the age to render speculative truth practical. Bacon, moved by the pervading spirit, had contributed more than any man to forward and extend the impulse he had himself received; and after the Restoration the physical sciences were in the very zenith of their popularity. Princes and bishops, statesmen and judges, courtiers, ladies, and poets, vied with each other, if not in extending the new philosophy, at least in celebrating its praises, and in attesting their sense of its importance. "Charles himself had a laboratory at Whitehall, and was far more active and attentive there than at the Council Board."* His patronage of the Royal Society (founded 1660, chartered 15th July, 1662) brought him into contact with men of science; and it was owing to an accidental discussion on a proposed method of finding the longitude at sea by lunar distances, that the king became aware of the defective state of astronomy, and the important use to navigation of improved tables of the moon, and (as a first step to them) of accurate plans of the stars. This was early in 1675.† The foundation of the observatory was laid August 10th, 1675, the site having been suggested and plans given by Sir Christopher Wren: the roof was already covered in at Christmas. Sir Jonas Moore, surveyor-general of the ordnance, was particularly active about the matter: he had been connected with the court as mathematical tutor to James, Duke of York, before the Commonwealth, (1647,) and had remained loyally attached to the Stuarts during their reverses. On his recommendation Flamsteed was appointed to the charge of the observatory: his title in the warrant is, "our astronomical observator;" and his duty is "to rectify the tables of the motions of the heavens and the places of the fixed stars, so as to find out the so much desired longitude at sea, for perfecting the art of navigation." The same object is indicated in the inscription, which still stands near the old entrance of the observatory, to the following effect:—

Carolus II., Rex Optimus,
Astronomiæ et Nauticæ Artis
Patronus Maximus,
Speculam hanc in utriusque commodum,
Fecit.
Anno Dni MDCLXXVI. Regni Sui XXVIII.
Curante Jona Moore milite,
R. T. S. G.‡

Flamsteed held his office from 1675 to Dec. 31st, 1719, when he died at the age of 73. Few men have left so conscientious a record of a life of toil. Less skilled in the theory and construction of instruments that Römer, he yielded to no astronomer of his day in his ideas of the precision and diligence required in making, recording, and reducing observations; and his "Historia Celestis Britannica" (posthumously published) will remain to all time, an imperishable monument of the history of the heavens at the commencement of the last age.*

The liberality of the government extended no further than to building the observatory and giving the astronomer a salary of 100*l.* a year; which Flamsteed used to say (and truly) he earned by labor "harder than thrashing." But the strangest neglect was, that no instruments were provided for him. He had not only to thrash, but *to find his own corn*. Sir Jonas Moore, his kind patron, did indeed give him some instruments, namely, a large sextant, two clocks, and a telescope; but government was deaf to his demands for money to construct others which he imperatively required, and which he eventually furnished from his own resources; so that, at his death, not one article contained within the bare walls of the observatory was the property of the crown—a circumstance which gave a color to the right which he and even some of his successors assumed in the property of the observations which they made. Flamsteed at first had a common laborer assigned to him, at the public expense, to take care of the buildings and act as his servant; and somewhat later he appears to have been allowed a computer or assistant instead. In general, however, he had two regular assistants, (who appear to have been engaged or apprenticed for a term of years,) and one of whom was paid by himself, as well as spare computers in the country, whom he almost constantly employed in the reduction of his observations and in the comparison of the places of the heavenly bodies with the then existing tables. Most of the computations were made twice by independent persons and compared by himself.

In 1710, in consequence of the complaints of Newton and others as to the impracticability of extracting any information from the Astronomer Royal, the president of the Royal Society, and a selection of its members, were appointed by the crown a commission of *visitors* to inspect the observatory, and report its deficiencies to the Board of Ordnance, to purchase Flamsteed's instruments, to instruct the astronomer *as to the observations he should make*, and to cause him to return to them annually a copy of the observations when made.† These summary powers were pretty regularly exercised. But no attempt was made to acquire Flamsteed's instruments for the state. On the

* Macaulay's "History of England," i. 409.

† See Flamsteed's Autobiography in Baily's Life, pp. 37–8; but particularly Flamsteed's letter to Sherbourne, in the same work, p. 125.

‡ These letters (as appears from the "Historia Celestis," vol. i., p. 26,) signify *Rei Tormentariæ Supervisore Generali.*

* Flamsteed's "British Catalogue" has been reprinted, with elaborate corrections and notes, by Mr. Baily. As a specimen only of its interest and importance to astronomy, we may mention that it contains six observations of Uranus—one in 1690, one in 1712, and four in 1715, (of course mistaken for a fixed star,) which have been of great use in the Theory of Neptune. For further particulars of Flamsteed's career, see an article on his life in this journal, vol. lxii., p. 359.

† "Baily's Life," pp. 90, 91. The warrant of Anne is dated December 12, 1710. In the Secretary of State's letter to the Board of Ordnance they are required to "have regard to any complaints the said visitors may make of the *misbehavior* of her majesty's astronomer."

whole, the appointment of the board of visitors was authorized by the circumstances of the time; and, as in later years their powers have not been tyrannically exercised, the existence of the board has really been of great service to the observatory, as we shall explain in speaking of its present state.

Flamsteed's really valuable observations commenced in 1689, when he employed his friend, Abraham Sharp, at an expense of 120*l.*, to construct for him the mural arc, which served to determine both the right ascensions and declinations of the stars of the "Historia Celestis," as well as of the sun, moon, and planets.* The divisions of the limb were estimated or subdivided by counting the revolutions of a screw at first,† and afterwards by diagonal divisions. It was 79½ inches radius. An arc of 5″ could be distinguished upon it. The Greenwich Observatory has always been known in the neighborhood under the familiar name of *Flamsteed House*, which, indeed, it still retains.

Flamsteed was succeeded in 1720 by Halley, long his keenest foe; who, being then sixty-four years of age, was certainly too old to execute properly the duties of so onerous a station; especially as he succeeded to the observatory in a totally unfurnished state, and therefore had to wait, to have instruments made, before his observations could commence. In 1721 he procured a transit instrument, as already mentioned, and in 1725 Graham finished an eight feet mural quadrant, the best instrument of the time, with which Halley continued to observe the moon, until 1737, when he became paralytic, and died in 1742, (June 14th.) His observations are preserved at Greenwich in the original MS., but have not hitherto contributed much to the progress of science, nor are likely now to do so.‡ Halley had no regular assistant;§ a serious disadvantage, since the observations of right ascension and declination were now for the first time made with different instruments, which besides were placed at some distance apart.

Bradley, the greatest British astronomer of the past century, and, like Halley, Savillian Professor at Oxford, succeeded him February 3, 1742. He had already acquired deserved celebrity by his discovery of *aberration*, or the effect of the progressive motion of light combined with the motion of the earth in its orbit, in apparently displacing the fixed stars. This was followed in 1747 by his discovery (also by observation) of the inequality called nutation, an irregularity in precession, afterwards proved to be occasioned by the attraction of the moon on the elliptical protuberance of the earth's equator, producing a small conical motion in the position of its axis. In consequence of these two effects of gravity and the motion of light, combined with the long recognized phenomenon of the precession of the equinoxes, all stars *appear* to describe (as seen from the earth) certain complicated little orbits, whose general period is a year, but which, not returning into one another, produce fantastical and not inelegant looped curves.* So considerable, in some cases, are these apparent motions, that the stars (called *fixed*) require to have their apparent places computed beforehand, just as the planets have, before any careful astronomical results can be deduced from observations compared with them. Thus, in the "Nautical Almanack" we have the place of *Polaris* calculated *for every day*, and many other stars for every tenth day of the year. These discoveries of Bradley were principally made by means of a zenith sector† (an instrument already described.) It was 12½ feet radius, and he considered its results true to *a quarter of a second*. It was constructed for him by Hearn and Graham, in 1727, and used at Wanstead, in Essex, where he resided with his uncle Mr. Pound, known by his skilful use of the monstrous telescopes then in vogue for measuring the diameters of the planets and the elongations of their satellites.‡ Bradley's sector was removed to Greenwich on his appointment, where it was continually used by himself and his successors down to 1812. It is still doing good work at the Cape of Good Hope, and is illustrious from its long service as well as from the extraordinary value of the observations originally made with it. Considering a correct knowledge of the places of the fixed stars (the landmarks of the sky) as the very foundation of accurate astronomy, it is hardly possible to overrate the practical importance of a discovery of the laws which regulate their apparently capricious motions; not to mention the beautiful physical induction of the cause, which afforded a *direct* proof of the motion of the earth in space, as complete as the annual parallax of the fixed stars, which was then so anxiously sought for.

Bradley entered on his duties at Greenwich with the utmost vigor, although he still continued annually his lectures at Oxford. In 1743, he and his nephew, John Bradley, (who acted as his assistant,) made no less than 18,000 observations; *on one day* (8th August) they took 255 transits—perhaps an unexampled effort.§ The instruments were Halley's, and they required much repair.

* The Czar, Peter, visited the observatory twice in 1698. On the 8th March of that year, after a double observation of Venus on the meridian, is this note: "Observante Serenissimo Petro Muscoviæ Czaro."

† This method, which would seem to belong to a more advanced stage of practical science, was due to Gascoigne, who first applied telescopes to divided instruments, and who constructed the first Micrometer. He died 1644.

‡ See Baily on Halley's Observations in Astr. Soc. Mem., vol. viii., p. 169; and Rigaud on Halley's instruments in vol. ix. of the same work.

§ Baily's Flamsteed, p. 362; Rigaud's Life of Bradley, p. li.

* Some of these are represented graphically in Captain Smyth's *Celestial Cycle*.

† The zenith sector, with a micrometer, appears to have been the invention of Hooke, and was used by him at Gresham College, in 1669, for ascertaining the parallax of the fixed stars. See Rigaud's "Life of Bradley," p. xii.

‡ Bradley himself, in 1722, measured the diameter of Venus with a telescope 212½ feet long! (Rigaud's Life, p. ix.) It should be noticed that the apparent orbit of γ Draconis was roughly made out, with Molyneux's sector at Kew, by Molyneux himself and Bradley, in 1725 and 1726.

§ Rigaud, p. liii.

It was not until 1750 that Bradley was provided with new instruments, excellent of their kind, through the liberality of George II., who granted 1000*l.* for this purpose, whereof 300*l.* was given to Bird for a new quadrant, and 73*l.* 13*s.* 6*d.* for a transit instrument by the same maker.* Bird made his quadrant everything which so imperfect an instrument admits of being made. Its accuracy of division could scarcely be improved. It had a double arc—one of 90°, and one with 96 divisions (this number was first selected by Graham for the convenience of continued bisection of the arc of 60°, which was set off by making the chord equal to radius.) By the comparison of the two arcs, contained in Bradley's printed observations, the difference rarely exceeds a second; and Mr. Pond admits, that, by his examination of the quadrant in 1811, the errors of division do not appear to be above that minute quantity, and the earlier observations with the instrument were in all respects perfectly good. By long use, however, (sixty-one years,) it had become gradually eccentric, and the error from this cause rose to 8″ or 10″ near the horizontal part of the limb.†

With so admirable an instrument, and so admirable an observer, the results could not but correspond; and the commencement of true precision in astronomy really dates from 1750. The observations, however, were not printed until long after,‡ and they were reduced as regards the places of the fixed stars in an admirable manner by Bessel. The reduction of the lunar and planetary observations, which are equally excellent and valuable, has only been performed within a few years by Mr. Airy, as will be mentioned in its proper place. Part, at least, of the range of building which constitutes the present working observatory was of Bradley's time, and dates from the year 1749.

Flamsteed, as we have seen, had a salary of only 100*l.* a year, which was further reduced by official fees. Halley and Bradley had officially no more; but Halley received a personal addition of 100*l.* a year, in consequence of having served as commander in the navy.§ Bradley was offered the living at Greenwich, but conscientiously declined it, on account of the absorbing nature of his duties. In 1752, however, he received a pension of 250*l.*, which was added to the official salary of his successors by George III. The salary has, very properly, been of late years still further increased.

Bradley's later efforts were successfully devoted to the improvement of the tables of the moon; and he died July 13, 1762, aged seventy. He was succeeded by his friend, Dr. Bliss, the third in succession who united the posts of Astronomer Royal and Savilian Professor at Oxford; but he died in 1765, after holding the office of Astronomer Royal only three years, and without leaving any observations of such importance as to require especial mention.

Doctor Nevil Maskelyne, of Catherine Hall and Trinity College, Cambridge, succeeded Bliss, in 1765. He retained the office for the space of forty-seven years, and died February 9, 1811, at the age of seventy-eight. At the time of his accession, more stringent rules were laid down by the Royal Society (the official visitors) for ensuring the habitual residence of the Astronomer Royal at Greenwich, and the complete devotion of his time to its increasing duties. Down to this period some doubt had even existed as to the right of property in the observations made at the National Observatory. Flamsteed's heirs, we have seen, claimed the papers in which were recorded his life-long labors as their property. Halley, who had always been clamorous for the public right in Flamsteed's observations, when pressed, in his turn, by the Board of Visitors, avowed his intention of keeping possession of his observations of the moon, that he might get the reward for the discovery of the longitude!* Bradley's observations were likewise retained by his heirs, and a lawsuit, raised by the crown, in 1767, to recover them, was abandoned in 1776. During Maskelyne's long tenure of office, he was entirely devoted to its duties, making himself all the most delicate observations, particularly those of the moon, and rarely quitting the observatory, except to attend the meetings of the Royal Society. The perfect method and continuity of his observations give to them a great value, especially for the correction of the Lunar Tables, in which respect they are indeed without a parallel. But the regularity of their publication was not their least merit. Four large folio volumes include with perfect method the patient labors of a life (for he had but one assistant.) Delambre, in his character of Maskelyne, says, that if through some catastrophe the whole materials of science should be lost except these volumes, they would suffice to reconstruct entirely the edifice of modern astronomy.

Maskelyne was drawn to the study of practical astronomy by the great eclipse of 1748—which had a similar influence on the mind of Lalande. He was recommended by Bradley for observing the transit of Venus, in 1761, at St. Helena; and, though the primary object of the expedition was lost through cloudy weather, he made other valuable observations, especially for the determination of the longitude, both by lunar distances and by chronometers. With the same view he went afterwards (1763) on a voyage to Barbadoes with Harrison's timekeeper; and from 1767 to the time of his death he superintended the publication of the "Nautical Almanack," a work of infinite use

* One of the most admirable instruments in the observatory was the clock by Shelton. It bore Graham's name, and appears to have cost 39*l.* See Rigaud's "Life of Bradley," p. lxxiv.

† "Greenwich Observations for 1812," p. 234. This instrument is now in good preservation at Greenwich. He corrected the collimation by means of his zenith sector which he removed from Wanstead.

‡ By Dr. Hornsby, Savilian Professor at Oxford in 1798,

§ Caroline, Queen of George II., who visited the observatory in 1727, obtained for him this advantage.

* His MSS. were ultimately purchased by the Board of Longitude for 100*l.*

to seamen, of which he edited no less than forty-nine volumes. In 1774 he made his memorable observations on the attraction of Mount Schiehallien, in Perthshire, for the determination of the earth's density; a work of great delicacy, which he executed under disadvantageous circumstances with consummate skill and address.* With regard to the instruments employed by him they were those of Bradley, with improved object glasses; but he had prepared for superseding the quadrants before his death. Troughton's Meridian Circle was ordered by him, although it was first used by his successor in June, 1812. On the whole, Maskelyne left behind him an enviable reputation. From a perfect devotion to the duties of his office, and a most candid and amiable temper, he was with equal justice both respected and liked by his contemporaries abroad as well as at home.

Mr. Pond, the next Astronomer Royal, resided at Greenwich from 1811 till 1835, when he resigned his office through the pressure of bad health, and died the following year. He had a peculiar skill in the theory of instruments, and the correct interpretation and application of the results afforded by them.† Himself the possessor in early life of a small but very perfect circle by Troughton, he published, as an amateur astronomer, determinations of the places of the fixed stars equal, if not superior, to those determined by public observatories; and demonstrated the increasing errors of the Greenwich Quadrant, due to the eccentricity occasioned by friction on its centre. This error is wholly avoided in circular instruments. At Greenwich he first used Troughton's Circle; and afterwards added Jones', and made observations by reflection. He gradually increased the number of assistants from one to six—a most important innovation, rendering Greenwich Observatory capable of far greater efforts than his own infirm health enabled him to undertake, but of which full advantage has been taken by his successor.

The present Astronomer Royal, Mr. Airy, formerly Plumian professor, and director of the observatory at Cambridge, was appointed to Greenwich in 1835, on the resignation of Mr. Pond. Before we proceed to give some account of his labors, which include, of course, the present operations of the observatory, we will endeavor to give the reader an idea of its present state, or rather, to speak more accurately, its state until a few months ago, before certain alterations of an important kind were commenced, which we will briefly advert to in the sequel.

We have already stated that the Astronomical Observatory consists of two distinct groups of buildings—the older castellated part, of the time of Flamsteed, and the low range, of Bradley's and Maskelyne's time: we shall commence with the former. It consists of a great centre tower and two wings. The tower in its lower part is occupied by the dwelling apartments of the Astronomer Royal. Its upper portion consists of a noble octagonal hall, with lofty windows, and balconies, intended for the use of large movable telescopes and quadrants; but this room is not at all used now for such purposes. A narrow staircase leads from one of its corners to the leads on the top of the observatory; commanding a very noble view over the whole of London, and a great part of the course of the Thames, and overlooking, of course entirely, Greenwich Hospital and its domes, as well as the town of Greenwich, and the cheerful slopes and deep woody recesses of the park. Here are disposed several meteorological instruments, which require a free exposure—particularly Whewell's and Osler's self-registering anemometers, which record on paper the direction and quantity or force of wind during the twenty-four hours that elapse between each inspection of them.

Here, also, we find a singular mechanism surmounting the eastmost turret of the old building. It is a pole, with a weather vane and a large black cross arranged horizontally at the top. Below the cross, on the vertical stem supporting it, slides a black ball about six feet in diameter: it may be raised by a simple mechanism until its upper edge touches the arms of the cross, which prevent it from going higher; but in its ordinary state it remains down at the lower part of the staff. The object of this useful apparatus—called the *Time Ball*—is to give notice to the whole shipping of the Thames and port of London, of the exact time—by dropping it daily from its highest position on the staff at the precise instant of one o'clock—Greenwich time. The business of the assistant, who has charge of it, is, by means of a winch in the lower part of the observatory, to hoist up the ball to its highest position touching the cross *five minutes* before one o'clock every day, including Sunday. There is a time-piece, compared with the observatory clocks, which stands near the winch, and also a species of trigger, by which the ball is suddenly detached and allowed to fall by its own weight, which is considerable. To prevent the shock of the fall from injuring the apparatus, the ball is connected with a piston eight inches in diameter, slipping in a cylinder containing air, which thus deadens the shock as by a cushion. The duration of the fall is immaterial to the observation. It has lately been proposed to observe the transit of the ball across several horizontal hoops; but the accuracy of the observation at present appears to be quite adequate to the end in view. At the instant of one o'clock the trigger is withdrawn, and the separation of the ball from the cross is visible to all the ships, which have chronometers on board; and they may thus have their errors ascertained, without the trouble and expense of sending them up to the observatory, and the more serious drawback of the probable change of rate which the shaking of land carriage is almost sure to occasion. To check the possibility of error on the

* Phil. Trans. for 1775.

† Mr. Airy, in one of his Annual Reports, states that he regards Mr. Pond as the principal improver of modern practical astronomy.—*Report to Visitors*, 1846, p. 9.

part of the time-ball assistant, another stationed in the observatory notes the moment of the fall of the ball, and registers it daily in a book. The error in time does not usually exceed one tenth of a second; and does not amount to three tenths of a second oftener than once in six weeks.

In the western wing of the old observatory there is a dome, under which was formerly an equatorial telescope. The position being, however, unfavorable, the telescope has been dismounted and sent to the Cape.

Near this was (till lately) the Zenith Tube Room. This instrument is a modification of Bradley's zenith sector, for measuring small zenith distances (especially for the star γ Draconis, which passes within a few minutes (north) of the zenith of Greenwich,) and it was intended, of course, to be an improvement on that celebrated instrument. It consisted of a tube twenty-five feet long, varying in diameter from six to ten inches, and furnished with a five inch object-glass at the upper end. The tube had no motion except round a vertical axis: zenith distances, therefore, were measured not by the motion of the telescope upon an arc, but by the observation with a micrometer of stars passing through the field. It is needless to describe its action more particularly; for all the skill of Pond and Airy, and all the mechanical dexterity of Troughton and Simms, failed to obtain any satisfactory results with this gigantic instrument. The errors of observation constantly amounted to $2''$ or $3''$; exceeding those of the ordinary mural circle, and utterly destructive of any hope of measuring by this instrument the parallax of the fixed stars. This failure is an instructive example of the serious difficulty attending the construction and working of gigantic instruments, and the fallacy of the plausible expectation that *unlimited* accuracy may be obtained by mere enlargement of scale in our apparatus. Among other sources of error (difficult to foresee or avoid) the pertinacity with which spiders infest zenith sectors has been notorious ever since Bradley's time. These little animals, finding the dark, cool, undisturbed tube a desirable lodging, spin their threads there so assiduously as to entangle the motion of the plumb line, upon whose absolute verticality the accuracy of the instrument depends; and it is difficult either to perceive or remove them. The cunning spider, in thus perplexing astronomers, may be thought, perhaps, only to retaliate upon them for equal vexations which they have entailed upon the busy race of cobweb-spinners; since the very instrument in question, and almost every other in the observatory, is provided with spider lines (technically called *wires*) in the eye-piece, for fixing the position of a star in the field of view of the telescope; and, to provide these, the optician is in the habit of training a certain kind of spider—which furnishes the best thread for spinning long lines—to serve his own ends, not theirs, to catch stars, not flies:—*Sic vos non vobis!*

The zenith tube having been found ineffectual, is now dismounted, and the apartment otherwise appropriated. Mr. Airy has, however, devised an altogether new instrument for the same purpose, in which the principle of reflection at a quicksilver surface is to replace the clumsy and inaccurate plumb line; but the particular contrivance we can hardly hope, within our limits, to render intelligible.

In the eastern part of the old building, and near the trigger apparatus of the time ball, is an equatorial telescope, by Ramsden, known as Shuckburgh's Equatorial. It is not, however, much used, since a larger instrument of the same kind has since been added to the establishment.

We now enter the Observatory Proper, at its west end (which also communicates, by means of a covered passage, with the astronomer's house,) and we first find ourselves face to face with that fine old brazen quadrant by Bird, eight feet radius, mounted on a pier so that the telescope points to the southern meridian, and which furnished the admirable declination observations of Bradley and Maskelyne. It is in all respects preserved as when in use, although now of course never employed—being superseded, since 1812, by the mural circle. On the *west* face of the same stone pier, the east side of which is occupied by Bird's quadrant, is Graham's old iron quadrant: it was made for Halley, but was redivided by Bird for Bradley, who used it for his earlier observations, and also for his later ones north of the zenith. As this instrument is little more than a venerable curiosity, the present astronomer has ingeniously managed, without injuring or removing any part of it, to convert the little room connected with it into a fire-proof room, for the preservation of the valuable MSS. connected with the observatory: they include a complete set of all the astronomical observations made at Greenwich. Here we have Flamsteed's voluminous MSS., many of them first brought to light and carefully arranged and bound by the indefatigable care of Mr. Baily; and also Halley's rather confused memoranda (never printed) of his tenancy of the place. Of Bradley's observations there is only a MS. copy taken from the originals in the Bodleian, under Mr. Airy's inspection. It may be regretted that the trustees did not think themselves entitled to surrender the MSS. themselves, to which the public have evidently an equitable, if not an undeniable legal, right. Of course Maskelyne's and Pond's MSS. are found here, and there are now carefully preserved the *jotting books*, with indelible metallic pencil writing, in which each individual observation is at the time noted by every observer in the establishment. The correspondence of the astronomers royal, as far as collected, is also here preserved.

The next room, to the eastward of Bird's Quadrant, is the Computing Room—the grand scene of labor of the whole observatory. It is only by exception that the astronomer or his assistants are to be found *using* the instruments, even during the regular hours of observatory work; but they are

nearly sure to be found assembled in the computing room, busied, at different tables, with their silent and laborious tasks—the assistants on watch turning an eye now and then to a small time-piece, which regulates their task of allowing no celestial object of consequence to pass the meridian unobserved. When we come to speak of the personal establishment of the observatory, we shall try to explain how it is that the calculating work is so much more heavy than that of observation.

Next in order comes the Transit Room. The instrument which gives the room its name has been already explained. The Greenwich transit is ten feet in length—the object-glass by Dollond, the mounting by Troughton; it was set up in 1816. The eye-piece contains seven vertical "wires," (in reality spiders' threads;) and the time of passage of each celestial object over every one of these is noted, and the mean taken. The mean or average direction of the whole seven wires determines the ideal line, called the "line of collimation," or optical axis of the telescope. If any of the wires have been missed by accident, a table is provided, by which the mean result, with those actually observed, may be reduced to the ideal mean. Suspended from the roof, above the instrument, we observe strong braces and pulleys, of formidable appearance, recalling the instruments of torture of which traces may still be found in some ancient prisons. An apparatus of question no doubt it is. The telescope, if suspected of wavering by a hair's breadth from the meridian line of truth, is forthwith seized and pinioned by the assistants; and, its unwieldy mass having been lifted by main force from its piers, it hangs dangling in the air, until, having been swung horizontally round, it is allowed to seek repose again in its Y's, the ends of the axis having been reversed in position. If the line of sight (or collimation) be correct, the meridian wire will fall on the selfsame spot as before. Should it deviate from the expected place —deviate, though "but in the estimation of a hair"—but a single second, the very brass of the telescope would blush a copper red! We shall say no more here of the verifications of the transit instrument, save that there is a meridian mark at Chingford, on the Essex hills, placed, in 1824, by Mr. Pond. As there is no doubt that it was *absolutely* in the meridian at that time, it may be interesting hereafter to verify the perfect persistance of the direction, on the earth's surface, of the N. and S. line; that is, the constancy of the axis of rotation of our globe.*

Beside the transit stands, of course, a clock, This one is by Hardy, an eminent maker, who died now many years since; and it has been, in part, remodelled. Its performance is quite satisfactory; by which we mean, not that it never goes sensibly wrong, but that its rate (*gaining* or *losing*) is constant, or nearly so, for many days together, so that its error may be at any time allowed for. The most fundamental of all the observations is the knowledge of *time*. Now the mere error of observation with a good transit instrument, when seven wires are observed, is not perhaps $\frac{1}{20}$ of a second of time; hence only the very best determined objects can be employed for determining the clock error. Such are called *clock stars*—the sun himself being never used for this purpose—since the errors of the solar tables (or of the theory of the earth's motion) are still sensible. A consequence from this is, that the astronomical clock does not indicate the time from noon, or the sun's passage. We are surprised to see an observatory clock pointing to eight or twelve o'clock when we know that it is four o'clock by St. Paul's; and still more—going, a few months after, at the same hour—to find that the clock is giving totally different information. We are apt to think that the astronomers are so taken up with dividing a *second*, that they lose count of the *hours*. But the fact is, that the astronomical clock is regulated by the stars, not by the sun, and shows what is called *sidereal time*. Its twelve o'clock, or noon, is when the equinoctial point (in Aries) is on the meridian; and, as a matter of course, the clock at any moment tells what part of the circle of right ascension is on the meridian; and, conversely, by noting the moment of transit of a celestial object, its right ascension becomes known without any calculation. Our civil reckoning is regulated, very reasonably, by the sun, because daylight determines the order of our occupations; but the astronomer knows no such distinction; and the sun is to him merely an object having such and such a right ascension on a particular day, and to be observed in course among the others.

The mode of making a transit observation is as follows:—The assistant in charge of the transit instrument is warned, by his sidereal timepiece approaching the hour which corresponds with the right ascension of the object he is to observe, that he is to prepare for the observation. The shutters of the slits in the roof are probably already open. If the object be the sun, the telescope is protected, by a screen near the object-glass, from the direct rays; for so sensitive is this instrument to unequal temperature of its parts producing a deviation of its axis, that the approach of a man's body to one side or other will twist the line of collimation; hence, transit instruments are often cased in flannel. Having adjusted the telescope to the anticipated altitude of the object in the meridian, by means of a small circle attached to it for this purpose, he seats himself in a very comfortable chair with a reclining back, similar to that in which most of our readers have reclined in a dentist's room. The observing-chair rolls back or forward at a touch by means of a railway which follows the eye end of the telescope, whilst the observer keeps his

* Mr. Pond used this meridian mark with the aid of a collimating telescope on the south of the transit instrument, to ascertain the line of collimation in azimuth without the necessity of reversing the instrument. (See Greenw. Obs. 1832.) As we have spoken above of the *absolute* coincidence of the line of collimation with the meridian, we should add that the astronomer does not aim at this, but allows, by calculation, for the small deviation which he ascertains.

head supported by means of the adjustable back aforesaid. When the object is *high*, the observer is *low;* if the object be a star in the zenith, the observer lies almost on his back ; and, in this very agreeable posture, he might surely be excused for indulging in a nap! We have not ascertained whether the code of laws of the observatory contains a punishment for so dreadful an offence. Be this as it may, taking an observation is no sleepy matter ; the tremble of impatience for the entrance of the star or planet into the field of view, is like that of the sportsman whose dog has just made a full point, and who awaits the rising of the game. When the star appears, the observer, in technical language, *takes a second from the clock face;* that is, he reads the second with his eye, and counts on, by the ear, the succeeding beats of the clock, naming the seconds mentally. As the star passes each wire of the transit he marks down in his jotting book, with a metallic pencil, the second, *and the second only*, of the observation, with such a fraction of a second as corresponds, in his judgment, to the interval of time between the passage of the star and the beat of the clock which preceded such passage. This interval may be estimated either by the judgment of the ear or of the eye. In the latter case, the observer registers in his memory the position of the star relatively to the wire at the preceding and following clock-beat, and subdivides the space mentally.* Before Maskelyne's time, the second was only rudely divided by certain signs of *less* or *more;* but, since 1772, the transits have been noted in decimal fractions of a second; and an experienced observer will never commit an error exceeding $\frac{1}{10}$ of a second on each of the seven wires. The observer then carefully takes the hour and minute from the clock, and adds it to the *last* observation. Stars not very near the sun may be seen and observed with the telescope in broad daylight—an effect of optical power not altogether easy to account for, and deserving of further investigation by experiment. At night, the field of the telescope must be enlightened by a lamp shedding a ray through the transverse axis, so that the spider threads may be distinguished against the brighter ground.

The observations with the transit instrument have two distinct purposes : *first*, the determination of *time* from objects whose right ascension is known (clock stars) ; *secondly*, the determination or correction of right ascension of objects from the true time of passage across the meridian. The clock stars themselves have had their places ascertained in this manner, and cannot be regarded as ever *perfectly* known. When less than four such stars (taken from a list including about sixty principal stars, none of which are less than 50° from the pole, so that their passage across the meridian shall be nearly as rapid as possible) are observed on the same day, their mean result is taken, to give the clock error ; but when more than four are observed, the clock error being similarly ascertained, the right ascension of the individual stars thus used is also calculated and entered in the reduced observations ; because it is concluded that our knowledge of the differences of the right ascensions of these bodies will be perfected by such an observation, and in the long run (being carried from star to star round the heavens) will correct the very individual places whose *collective* accuracy was assumed in the determination of the clock rate—on the knowledge of which the accuracy of those intervals evidently depends. Thus astronomers do really in one sense reason in a circle; but yet have reason on their side—for it is evident, on consideration, that the accumulation of good observations of well determined stars will tend to annihilate the effect of the error of place of any one or two stars upon the clock-rate, and at the same time bring out the discrepancy in the right ascension of those particular stars.

But we now pass to the Circle Room. Here, in 1812, was mounted the masterpiece of Troughton —the six feet mural circle for ascertaining the altitudes of celestial bodies on the meridian, and thence their polar distance. A second similar one, by Jones, for observations by reflection, was mounted in 1824 ; but Mr. Airy having, by a particular method, which he adopted at Cambridge, been enabled to obtain as satisfactory results with one circle as with two, Jones' circle was sent, in 1839, to the Cape, where it still remains. The circle is provided with six equidistant microscopes, fixed to the stone piers in such a manner that, when the circle is turned on its axis, the divisions on it pass rapidly through the field of view of these microscopes, which are also provided with fine spider lines whose motions are ascertained by counting the revolutions of a screw ; and thus the subdivisions of the spaces on the divided circle are ascertained to great nicety, the mean of the readings of which not only effectually destroy any error of centering, (which vitiated the old quadrant observations,) but in almost every possible case correct casual errors of division.

It is in contemplation to supersede both the mural circle and transit instrument by a transit circle, (now in preparation,) with which is connected a telescope of very large dimensions.

Beyond the circle room are three apartments devoted to the assistants ; and ascending a narrow stair, we find, first, a comfortable and well appointed Library of astronomical and scientific works, carefully arranged, catalogued, and bound, which are used exclusively by the persons connected with the establishment. The present Astronomer Royal, who has added greatly to the efficiency and completeness of the library, states that it has been found to be most useful in diffusing a taste for science among his subordinates, and in enlarging the circle of their acquirements.* Several hundred pounds have been judiciously applied by the Admiralty to this desirable object.

Adjoining to the library is the Chronometer-

* This was Bradley's invention. Rigaud's Life, p. lv.

* Astronomer Royal's Report, 1837, p. 2. Again (1846, p. 3) he says, "The library is accessible, under simple regulations, to all the assistants, and is producing a marked effect upon their education."

Room. On entering, the visitor is startled by a universal buzz, which sounds almost like the hum of the beehive. It is occasioned by the beats or *ticking* of many rows of chronometers, the property of the Admiralty, or of individual makers who have sent their watches on trial, prizes being occasionally awarded to the most perfect, besides that those found to go most regularly are always purchased for the public service. Two broad shelves on three sides of this room are usually covered with these delicate and valuable machines, whose aggregate worth is never under several thousand pounds. In 1842, there were no less than one hundred and seventy chronometers on trial; at present there are not so many. They are *rated* for the most part daily, and by two persons, to avoid error. The whole process is curious enough. At one o'clock every day the two assistants in charge repair to the room, where is a timepiece set to true time. One person opens the lids of the chronometers, (which are almost all in boxes,) and winds up each with its own key. His second follows a little after, verifies the fact of each being wound up, and closes the lids. The object of this is to still the din of ticking, which would prevent the clock-beats from being distinctly heard in the comparison. One assistant then takes each watch in succession in his hand, and, reckoning by the eye a second from the clock-face, counts the beats whilst he compares the chronometer by the eye, and in the course of a few moments he calls out the *second* shown by the chronometer when the clock is at 0 second. This number is registered in a book by the other assistant, and so on throughout. They then change places, the second comparing, and the first writing down; but this last precaution is sometimes omitted. The *minutes* are compared with the clock but once a week. From these books of daily comparison are deduced the daily rates by which the goodness of the watch is to be estimated. The errors are chiefly of two classes—that of general bad workmanship, producing a *lawless* variation in the rate, and that of *over* or *under* correction for temperature, (or *compensation*, as it is called,) which may occur even in a watch otherwise perfectly well made. The difference of the greatest and least rate in the course of a twelvemonth, when the watch has been exposed to all the annual changes of temperature, may be ascribed principally to the latter fault; but abrupt changes, shown by comparing one week's mean rate with the next, are considered to be due chiefly to indifferent workmanship. A chronometer is judged of on the whole by a combination of these two tests; yet it is easily seen that such combination is in a great measure arbitrary, and that the selection of a chronometer must depend a good deal on the particular service for which it is to be used. If, for instance, it is to be sent to extreme climates, the perfection of the temperature correction will be most regarded. We must add, that in the middle of the apartment is a stove, and over that stove a large iron tray or pan, which may justly be termed *purgatory*. Here the chronometers, doomed to the highest trials of virtue, do penance for a period in artificial heat, and, when their rates have been taken, are plunged in snow; thus made to

> ———feel by turns the bitter change
> Of fierce extremes—extremes by change more fierce;
> From beds of raging fire to starve in ice
> Immovable, infixed, and frozen round
> Periods of time; thence hurried back to fire.

The great care and attention which all chronometers sent on trial to the Royal Observatory invariably receive, as well as the perfect impartiality and authenticity of the reports on their performance, afford great encouragement to this branch of national manufacture—one of vast importance to the safety, convenience, and perfection of navigation. But, notwithstanding the astonishing rapidity with which, by long practice, the comparisons are made, the detail of the chronometer department of the observatory is a very heavy one, and, in fact, occupies no inconsiderable fraction of the strength of the establishment.* The service thus conferred on navigation is too direct, and is too closely connected with the primary objects of the observatory, to be given grudgingly; it must be, however, recollected that so much power is withdrawn from strictly scientific work, and that no part of the chronometer-work appears in the "Greenwich Observations."

Near the chronometer-room is the South-East Dome, occupied by a fine equatorially mounted telescope. The object-glass was munificently presented to the observatory by Mr. Sheepshanks; it is 6¾ inches in diameter. This instrument is valuable for ascertaining approximately the places of comets, &c., out of the meridian; and, being fitted with a double-image micrometer, contrived by Mr. Airy, (described in "Greenwich Observations," 1846, p. lxxxvii.,) can be used for ascertaining the distances of double stars, the diameter of planets, &c. But these observations are only occasional, not systematic, in this observatory.

There is another dome connected with these buildings, which is entered by a small stair close to Bird's Quadrant, (see p. 445,) but which we have hitherto purposely abstained from mentioning, in consideration of its being occupied by an instrument expressly intended to be supplementary to those already described. This is the Altitude and Azimuth, or south-western Dome; it is on the second floor of the "advanced building" formerly spoken of as the site of Flamsteed Mural Arc. We have alluded to the inconveniences attending the use of altitude and azimuth instruments, such as those of Palermo and Dublin. But Mr. Airy considered the special advantage to be derived from observing the moon in parts of her orbit when, on account of the sun's proximity, she is invisible in meridional instruments, to be worth the trouble and expense of constructing a circle with extraordinary

* In 1842, Mr. Airy stated that the chronometer work occupied the greater part of the time of three assistants. We must, in strict accuracy, add that it is not *usual* to expose the chronometers to the action of frigorific mixtures; but they are sometimes employed when the makers desire it. See *Parliamentary Return on Admiralty Chronometers*, 29th July, 1849.

precautions for stability, and of undertaking calculations, of great length and intricacy, for deducing the moon's place at such times. The extraordinary pains with which for more than one hundred and seventy years the moon's motions have been followed at Greenwich, and the happy result, in the improvement of the lunar tables, as well for the use of navigators as for a test of the theories of physical astronomy, have given to the British National Observatory an undisputed preëminence in this department. As the greater part of the lunar irregularities depend in some way or other upon her position in regard to the sun; and as the moon scarcely ever can be observed on the meridian when her time of passage is within four hours on either side of the sun, it is easy to see that nearly one third of her orbit (relatively to the sun) is unobserved and untested. It was to supply this defect that Mr. Airy recommended and effected the erection of this instrument, which is of singular solidity, with horizontal and vertical circles three feet in diameter. By a comparison of the moon's place with that of well ascertained stars, *in any part of her diurnal course*, observations may be made in the early morning, or in the evening, when the moon is a slender crescent, and the sun below or only a little above the horizon. Besides this, observations of the moon's place may at all times be obtained when the weather permits, although it may have been cloudy at the instant of her passing the meridian. The observation is made by the method of comparative transit of the moon and a fixed star, both across six vertical wires for azimuth, (the horizontal circle being fixed,) and six horizontal wires for altitude. The results are satisfactory in quality, being little inferior to those with meridional instruments; and they have increased the number of lunar places ascertained during the year by 75 per cent., and include observations of the moon even within *one hour* of the sun. It may be thought to be a great sacrifice of time and labor (absorbing the strength of one assistant at least) for a single object, the cost being at first 700*l.* or 800*l.*, and 150*l.* per annum afterwards. But on this subject Mr. Airy gives us the curious information, that the lunar observations, as previously conducted, might be considered to cost the country 1000*l.* a year, or *each single complete determination of the moon's place to be worth* 10*l.**

This completes our survey of the Astronomical Observatory. We have only space to glance for a moment at a subordinate department, which some of our readers will perhaps consider the more interesting of the two—the Magnetical and Meteorological Observatory. We regret that it is impossible for us here to do more than meagre justice to this subject.

A knowledge of terrestrial magnetism has always been most intimately connected with that of navigation, and in some measure, also, with astronomy—meteorology little less so. The diurnal variation of the needle—the most important discovery next to its polarity and variation—was ascertained by Graham, the clock and quadrant maker of the Greenwich Observatory in the time of Halley. Bradley made observations of the same kind; and so occasionally did Maskelyne and Pond. About fifteen years ago, however, a grand revolution was made in the science of terrestrial magnetism, chiefly by M. Gauss, a celebrated German mathematician and astronomer, who had the rare merit at once of inventing instruments capable of ascertaining variations in the force and direction of the earth's magnetical attraction, with a precision resembling the results of astronomy, and likewise of showing how these results, obtained simultaneously over a large part of the earth's surface, might be combined and connected, by mathematical formulæ, in such a manner as to represent, in an accurate and continuous manner, all the phenomena of magnetism at any point of the globe which might be selected, and so to register their changes from age to age.

Although Britain had not the honor of starting first in the magnetic race, yet she very speedily and honorably vindicated the position which her national consequence and widely-spread colonial territories strongly pointed out for her. Of course a *home* observatory—as complete, at least, as those equipped for Canada, St. Helena, the Cape of Good Hope, the East Indies, and Van Diemen's Land—was to be provided; and Mr. Airy at once volunteered to render Greenwich Observatory as effective in the magnetical as it has always been in the astronomical department. In 1838 a magnetic house or observatory had already been erected within a considerable enlargement to the southward of the old enclosure. After the usual number of official difficulties and delays, this appropriation on behalf of science was sanctioned by the commissioners of woods and forests and the ranger of the park. It would be fortunate, if all encroachments on the pleasure-grounds of the public could be so well accounted for. The edifice is of wood, in the form of a cross with equal arms, the general directions being *magnetic* N. and S., and *magnetic* E. and W. It required only additional instruments (for occasional observations had been made from 1838 until 1840, the period of which we now speak) and proper assistance to make the Magnetic Observatory all that could be desired. Besides magnetic bars, variously suspended, a complete system of barometers, thermometers, wind and rain measurers, hygrometers, actinometers, electrometers, and all other *ometers*, were gradually but effectively provided; and last, not least, a sufficient staff of observing assistants was attached to the already considerable establishment of the observatory. Their duty, indeed, was not light—more irksome even than that of the practical astronomer; for here the observations must be made, be the weather what it may, every two hours, day and night, from year's end to year's end, with the sole exception of the twenty-four hours of Sundays. These observations were of a kind which was then new and nearly untried; the instruments had to be

* Airy, Report, 1844, p. 5.

proved and adjusted in a thousand different ways before anything like the same confidence could be had in their use which for generations had attended the operations of astronomy. The calculations and reductions to be gone through were so extensive, that, in consequence and for a series of years, Greenwich Observatory has given to the world two thick quarto volumes of results instead of one—doubling, at least, the labors of the Astronomer Royal himself, although he generously neither required nor accepted any addition to his official income on the occasion.

This cross-like building, then, contains three principal instruments, or suspended magnets, disposed so as to influence as little as possible one another's motions. We have, first, a horizontal bar, suspended by a long bundle of silk fibres, which shows the change of direction of the magnetic north (declination or variation) at any moment. We have, in the second place, a magnetic bar, twisted—by means of the lines which suspend it—away from the magnetic meridian, so that it hangs nearly E. and W.; but, as the magnetic force of the earth increases or diminishes a little from time to time, the north end is a little more pulled to the north, or a little relaxed—so that the *horizontal force* of the earth's magnetism is measured by the arc described by the needle thus balanced between the opposing forces of torsion and attraction. Thirdly, we have the instrument for measuring the vertical magnetic force, which resembles the beam of a pair of nicely-poised scales—itself magnetized—but without any scales attached. The northern end of the beam tends to dip more when the attractive action of the earth, by any cause, increases; on the contrary, when it diminishes, the counterpoise on the south end of the bar tends to make it rise.

Each of these instruments is furnished with a small, flat mirror, (or something equivalent,) which turns as they turn. But every one knows that if we turn a looking-glass slowly round with the hand, fixed objects reflected in it appear to wheel about with a redoubled velocity. Gauss availed himself of this principle to watch the *seeming* displacement of a finely-divided scale of inches, viewed, by means of a telescope, as reflected from these moving mirrors; and thus, by an easy calculation, to infer the angular motion of the magnetic bars to which they are attached. The magnetic observers were then required to register, every two hours, the division of the respective scales which they saw reflected in the mirror of each instrument; and these *readings* were at leisure converted into measures of the changes which it was wished to record; namely, of the declination or variation, in minutes and seconds of a degree, and of the horizontal and vertical components of the earth's magnetism, in thousandths of the whole force.

These important and vastly numerous determinations having been corrected, as far as possible, for the index errors of the instruments, and for the effects of temperature on the magnetic force of the bars, have been regularly printed in the supplementary volume of the Greenwich Observations. But as it became evident that something like a perpetual registration of magnetic instruments must henceforth form part of the work of a National Observatory, the attention of scientific men has for some time been directed to the possibility of causing the instruments to record their indications in the absence of the observers, and thus save a vast amount of severe human labor and vigilance. Government was induced to offer a reward of 500*l.* for such a perfected system; and Mr. Brooke, a medical gentleman of London, has been fortunate enough to adapt the principle of *photography* to it with such success as to be fairly entitled to the reward. His method has now superseded entirely the system of day and night watches so long pursued at Greenwich. We can only very briefly indicate the process.

It has been seen that the mirrors attached to the magnets reflect the divisions of a scale of inches to the right or left, as the magnets move one way or other. Instead of the scale of inches, imagine a lamp continually throwing a narrow ray of light on the mirror in a fixed direction. As the magnet moves, the ray reflected from the attached mirror will turn to one or the other side, and the spot of light which it throws on a screen placed so as to receive it will travel over a greater distance in proportion as the screen is placed further from the reflecting mirror. Thus, without the smallest friction, we have a spot of light moving over a space which represents, upon any desired scale, the angular motion of the magnet. But now let the surface on which the spot of light shines be of photographic paper, placed in an apartment otherwise dark; let it envelop a cylinder turning round a horizontal axis once in twelve or twenty-four hours, and the path of the luminous spot, from instant to instant, will be recorded by a discoloration of the sensitive paper. This impression is then made permanent, by the usual process, and the papers being removed are preserved as perpetual records of the continuous fluctuations of the several magnets. To give an idea of the scale on which the registrations are made, we may state that 1° of the declination magnet covers five inches of the photographic scale (corresponding to a circle of twenty-four feet radius); a variation of one thousandth part of the horizontal component of the earth's magnetic force causes a deviation of the spot of light through twenty-four hundredths of an inch on the paper; and a similar variation in vertical force produces a motion of fifty-two hundredths of an inch. The photographic indications are checked by means of four or five readings of the instruments, made daily at convenient hours, according to the old method; and the positions of the magnets at other hours are deduced from a comparison of these with the luminous tracings. A few of the leading results are deduced numerically from the tracings, and set down in the observation books for printing. But as the precise value of the scale of the tracing is determined each day by a com-

parison with direct observation, the reading off of each day's tracing requires its own proportional scale to be applied. This is done in a way as simple as it is ingenious. A slip of vulcanized India rubber stretched in a frame, and admitting of extension by turning a screw, has a scale of divisions drawn upon it, which scale may be shortened or lengthened, by means of the screw, until it is adjusted to the scale of the tracing for any particular day, any part of which may thus be read off in correct units, by merely applying the elastic scale to it.

The light hitherto used for photographing is that of the camphene lamp, but it is expected that a substitute less liable to the annoyance of smoke and occasional derangement will be discovered. The magnets, lamps, and registering cylinders are shut up from the daylight in zinc cases. When an examination of the apparatus is to take place, the window shutters being closed, the superintendent takes a common lamp or candle, protected with a *yellow* glass, which sheds plenty of light, but light containing so few chemical rays as not to affect the sensitive paper whilst his examination is proceeding. We may add that the thermometer and barometer are both photographically registered; the former very simply and effectually, the latter (as might be expected) with less success at present.

The duties of the magnetic and meteorological department, which lately required the undivided attention of four persons, will for the future be performed by two.*

We have thus hastily gone over the chief parts of the observatory, omitting, however, many minor details; and we must now attempt, in conclusion of this long article, to explain the excellently methodical way in which the onerous duties of this great national establishment are performed by the persons attached to it.

The Personal Establishment has for some years consisted of the Astronomer Royal, G. B. Airy, Esq.; the Chief Assistant, the Rev. R. Main; five Astronomical Assistants; the principal Assistant in the Magnetic Department, Mr. Glaisher, with three other Assistants under him; besides occasional Computers employed from time to time, in number from two or three to as many as fifteen.

And first we have the Astronomer Royal himself, the nature of whose office has been already generally explained. The precise outline of his duties (never very clearly prescribed) has undergone in practice considerable modifications. Whilst the whole business of the observatory was left to be performed by the astronomer and one assistant only (as was generally the case previous to the appointment of Mr. Pond) the astronomer undertook equally the labors of observation and calculation; but now that the establishment includes eight or nine subordinates, besides occasional computers, it will be easily understood that the adequate direction of so considerable an amount of manual power (for the duties of the subordinates are almost strictly mechanical) affords full employment for the intelligent head who has to direct all, and who is responsible for the labors of all. And, indeed, when we consider the great number of instruments of different kinds in almost hourly use, the number of errors to which each instrument is especially liable, and the vigilance requisite to detect them; the fatigue of the immense calculations connected with the proceeds of almost every observation, and the pertinacity with which errors *will* intrude themselves into every kind of calculation, *especially the simplest*—when we reflect besides that the progress of science is quite as rapid in practical astronomy as in almost any other department, and that the national astronomer is responsible for the character of his observatory, his instruments, and his results, and is ever on the watch for introducing improvements from abroad or those which his own experience may suggest—that he has, besides, many duties of a nearly mechanical and official, but of an important, kind, imposed upon him by his connection with the Admiralty—and, further, that he is frequently called upon by government for advice on scientific points, requiring much deliberate consideration, or even extensive experiments and the drawing up of elaborate reports; and that all astronomers in England or in the colonies look to Greenwich as a centre of astronomical information and experience, whence help may be looked for and advice obtained;—it must be apparent that an active and energetic Astronomer Royal, like the gentleman who at present, fortunately for science, fills the office, finds his time more than occupied, without himself making any of the current observations.

The hours of *regular* observatory work are from nine to two o'clock daily, except on Sundays; and for the greater part of this time the Astronomer Royal is to be found among the assistants of the astronomical department, in the computing room; where he oversees generally the work of the observatory, regulates what observations are to be made, receives reports of those made during the preceding twenty-four hours, and generally is open to reference on every subject connected with the instruments, the calculations, or the personal establishment. It is a rule enforced by Mr. Airy, that all communications not of the simplest kind between him and his assistants, are conducted in writing; and thus the daily details of the observatory, to the minutest particular, are preserved for future reference. The whole of the astronomer's extensive official correspondence is likewise methodized and preserved. The labor which this entails is rendered comparatively easy by methodical habits acquired through long practice; and a remarkable example of its utility has been shown in the recent publication of the entire correspondence relative to the discovery of Neptune and the perturbations of Uranus, published in the "Proceedings" and also in the "Memoirs of the Royal Astronomical Society." The correspondence includes the smallest scraps of letters which passed on this interesting

* The weekly meteorological averages are regularly communicated by the Astronomer Royal to the Registrar General of Births, Deaths, &c., and are published by him in his Reports.

subject; their ultimate importance in the history of this the greatest discovery of modern astronomy, could not at the moment have been even guessed at. Those who have read that truly interesting chapter of scientific history will admit, that whilst few persons of the most rigorous business habits could have produced from their archives a correspondence extending over so many years, and so elaborately complete, it would be still more difficult to instance a case displaying more perfect impartiality and frankness than were shown by Mr. Airy on this occasion, under circumstances of singular delicacy.

The Astronomer Royal is more especially responsible for the results of his observations as given to the world. The labor of keeping up the computations to the level of the observations, and of following up both by the irksome correction of the press, must perpetually occupy his most serious attention. From time to time elaborate reports of the state of the calculations are made to him in writing; and, generally speaking, every printed sheet is revised by him before going to press. Having thus distinctly and day by day before him the whole operations of the observatory, any irregularity is certain to strike his eye at once and be immediately corrected.

It may be proper to state that the Astronomer Royal receives his appointment by direct warrant from the crown; and that on the demise of the sovereign a new warrant is requisite for the reappointment. He is termed "Our Astronomical Observator," as in the time of Flamsteed. Although responsible to the Board of Admiralty for the charge and delivery of chronometers for the navy, and although he receives from them instructions regarding purely official matters, the astronomer does not consider himself under the direct control of that department. There is, however, one body connected with the observatory, whose functions are too peculiar to be passed over without notice, namely, the Board of Visitors.

The original appointment, (Dec. 14, 1710,) by warrant of Queen Anne, of the President, Vice-presidents, and certain Fellows of the Royal Society, selected by the council to act as visitors of the observatory, has already been referred to (page 441.) Although the unseemly disputes between Flamsteed and the members of this commission were little creditable to the parties, and although the interference of the visitors was not altogether effectual for the purposes contemplated in the warrant, it must be owned that the appointment of a scientific board of control and inspection, intermediate between the executive government and the Astronomer Royal, was almost essential, and has been attended with the happiest effects; and, so far as we are aware, not a single serious misunderstanding has occurred between the parties since Flamsteed's death. Whilst, on the other hand, the evil consequences of the want of some such power of inspection have been witnessed in other observatories both at home and abroad, where astronomers, after having obtained a lucrative appointment, instead of devoting themselves to their observatories, have wasted or misapplied the time for the employment of which in the scientific service of the public they were in the avowed receipt of public money.

The visitors' warrant has been from time to time renewed without very material alteration,* except that in the more recent (a copy of the latest is in our hands) the Admiralty is substituted for the Board of Ordnance, as the body to whom the visitors' report is made—and the Astronomical Society is united with the Royal Society in having representatives at the Board of Visitors. On the whole, there is rather a greater jealousy shown in these warrants than in preceding ones, of the authority which was originally solely confided to the scientific visitors; and there appears a tendency to throw more power into the hands of the Admiralty, which has not, however, we believe, been, in general, vexatiously exercised. The annual visitation is held at Greenwich on the first Saturday of June, when usually a considerable concourse of persons interested in science meet at the observatory, and afterwards dine together at the *Crown and Sceptre*. There is no question but that the recurrence of this annual reünion tends considerably to inspirit the astronomer in the performance of his retired and sedentary labors. Occasionally, but not often, visitations are held at other periods. It is agreeable to perceive that, owing to the general attention and zeal of successive astronomers, the Board of Visitors have most commonly had the pleasing duty of limiting their reports to recommendations to the government on the mode by which the suggestions of the astronomer for the advancement of his science may be best carried into effect. Such recommendations have been unusually frequent since Mr. Airy has presided over the observatory; for no previous Astronomer Royal has taken such unceasing pains to improve to the utmost the facilities afforded him by his position for perfecting both astronomical and other observations.

Were we to single out any specialty by which Mr. Airy's conduct of the observatory is distinguished from his predecessors, it is in the complete *reduction* of his observations. By *reduction* is technically meant the correction of the bare results recorded by the observer, for all instrumental and other appreciable sources of error, and the comparison of these results with the best existing astronomical theories, so as to afford the basis for still further improving them. Thus every observation of the sun, moon, or planets, is made to represent the right ascension and declination of the body at a given instant; and the "tabular place," or right ascension and declination, computed from the best existing tables, being also calculated, (usually by interpolation from the "Nautical Almanack,") the difference is set down as the error of the tables at that instant. Thus, likewise, the results of every

* See copies of some of these warrants and regulations in Weld's "History of the Royal Society," vol. i., p. 400, vol. ii., p. 27, &c., 250, 293. See also "Baily's Flamsteed," pp. 91, 307, and "Rigaud's Bradley," p. lxxii.

eclipse or occultation observed are so represented as to give conditional equations for the correction of the elements of the solar or lunar orbits. In like manner, the observations of the stars are combined, and cleared of the effects of precession, aberration, &c.; and the improved star catalogues which are thence deduced, are from time to time inserted in the "Greenwich Observations." It will be seen that all this involves an immense and ever-growing labor, which never was contemplated on the compiling of the earlier volumes of that work.*

The admirable system of reductions commenced by Mr. Airy whilst director of the Cambridge Observatory, was transferred by him to Greenwich. He appears to have been resolved to render the proceedings of our National Observatory not only the best and completest in the world, but the most accessible to men of science in their results. Accordingly, he voluntarily undertook the superintendence of the reduction of all the lunar and planetary observations of his predecessors since those of Bradley—commencing with 1750, when, as we have observed in another part of this article, astronomy first became accurate, according to modern notions. This gigantic task, involving the minute discussion and reduction of at least fifteen thousand rough observations, made with a variety of different instruments, of various degrees of perfection and adjustment, and extending over eighty years, is the greatest work of the kind that was ever attempted, and the most useful to astronomy. Every observation was compared with the corresponding tabular place, occasioning an equal number (15,000) of laborious computations—those of the moon especially.† The mere results, printed in the most abridged form, filled three ponderous quartos, extending to 2200 pages; the expense of this immense undertaking was defrayed by government, upon an application made by the British Association for the Advancement of Science in 1833. The calculations occupied in their gradual progress at least a dozen years; proceeding latterly with the utmost celerity, as many as sixteen computers being constantly employed in the great room at Greenwich, under the immediate superintendence of Mr. Hugh Breen, who just lived to see the work completed. The summary of these computations, as regards the correction of the lunar elements, is contained in a short paper lately communicated by Mr. Airy to the Astronomical Society (vol. xvii.). It embodies in a few lines the chief results of the system of Greenwich Observatory for nearly a century!

* It is not to be inferred, however, that such reductions were never made, although not systematically published. Mr. Airy has borne testimony to the industry and accuracy of his predecessors, Maskelyne and Pond, in conducting several important reductions, and especially comparisons of the moon's place with the tables, as proved from MSS. existing at the Royal Observatory. See "Report to Visitors," 1839, p. 3.

† The computation of a single tabular place of the moon, of which the steps are shown in the twelfth "Skeleton Form" of Airy's "Lunar Reductions," vol. i., is itself an undertaking formidable by its extent and repulsive by its intricacy. This had to be 8393 times repeated *in duplicate*.

The process for the correction of the elements (Mr. Airy wrote in 1846) is now going on; and the extent of the work, even after so much has been prepared, almost exceeds belief. For the longitude, ten columns are added in groups, formed in thirteen different ways, each different way having on the average about 900 groups. For the ecliptic polar distance five columns are added in groups, formed in seven different ways, each different way having on the average about 900 groups. Thus it will appear that there are not fewer than 150,000 additions of columns of figures. (Report to Visitors, 1846, p. 9.)

This prodigious work can however have but few readers. Few, indeed, are even competent to apprehend the greatness of the service it has rendered to science. No laudatory notice of it has appeared, so far as we know, in even one of our literary journals; and if testimony has been borne to its utility in one foreign periodical exclusively devoted to astronomy, the author's main reward for so great and so gratuitous an expenditure of valuable time and anxious toil must be, that it will be a consciousness of the vastness of the boon conferred by it upon all practical and theoretical astronomers in all time coming; whilst it is also the noblest monument which human hands could rear to the venerated memories of Bradley, Maskelyne, and Pond.

Mr. Airy's annual reports to the Board of Visitors (printed in the "Greenwich Observations") present a lively picture of the activity of the observatory since 1836, and should be read by any person desiring to make himself acquainted with the details of its management. But we refer to them now as showing that the reduction of the old observations has been only one of the many important labors in which the Astronomer Royal has engaged solely from scientific zeal, and in addition to his regular official duties. Among these we find a full investigation of the method of correcting ships' compasses in iron-built ships, the organization and reduction of a great series of observations on the tides, particularly in Ireland, besides an elaborate treatise on the theory of tides and waves in the "Encyclopædia Metropolitana." As a member of the commission for restoring the lost national standards of weight and measure, it fell to Mr. Airy's lot to draw up the report embodying the conclusions from a vast mass of evidence. He was likewise a member of the Railway Gauge Commission, and at one time much of his attention was drawn away to that purely mechanical inquiry. When astronomical instruments are to be contrived or adapted for any public service, he is naturally the person to be referred to, and his instructions are frequently required by the parties who are to use them. We must quote one instance of the nature of the services in which his energies have occasion to be directed. It is given in his report to the Observatory Visitors for 1844.

In my last report I stated that the officers of the corps of Royal Engineers, who were to trace the Canadian Boundary, had been placed here for instruction and practice in the use of instruments

under my eye. The most difficult part of the boundary was a straight line of nearly seventy miles in length, to join two defined points. The country through which this line was to pass is described as surpassing in its difficulties the conception of any European. It consists of impervious forests, steep ravines, and dismal swamps. A survey of the line was impossible; and a tentative process would have broken the spirit of the best men. I therefore arranged a plan of operations founded on a determination of the absolute latitudes and the difference of longitudes of the two extremities. The difference of longitudes was determined by the transfer of chronometers, by the very circuitous route from one extremity to the other; and it was necessary to divide the whole arc into four parts, and to add a small part by measure and bearing. When this was finished, the azimuths of the line for the two ends were computed, and marks were laid off for starting with the line from both ends. One party, after cutting more than *forty-two miles* through the woods, were agreeably surprised, on the brow of a hill, to see directly before them a gap in the woods on the next line of hill; it opened gradually, and proved to be the line of the opposite party. On continuing the lines until they passed abreast of each other, their distance was found to be 341 feet. To form an estimate of the magnitude of this error, it is to be observed, that it implies an error of only a quarter of a second of time in the difference of longitudes; and that it is only one third of the error which would have been committed if the spheroidal form of the earth had been neglected * * * * Transits were observed and chronometers were interchanged when the temperature was lower than 19° below zero; and when the native assistants, though paid highly, deserted on account of the severity of the weather, the British officers still continued the observations, upon whose delicacy everything depended.

But besides these contributions to the scientific department of the public service, Mr. Airy has during his residence at Greenwich continued to communicate to the Transactions of the Royal Society of London, the Astronomical Society, and the Cambridge Philosophical Society, a multitude of papers on mechanical, optical, and astronomical subjects, (including both physical and practical astronomy,) which might alone have appeared to give full employment for a man otherwise at leisure. But it is not our business to enter into these details, nor to discuss the philosophical merits of the Astronomer Royal, otherwise than in his strictly official capacity.

There is a good residence attached to the observatory, and (as we have already remarked) it would be difficult to find a spot which seems to speak more of complete repose and abstraction from the busy world (whose hum, however, is only just beyond earshot) than this forest lodge of Flamsteed House. Shall we wonder, then, if its tenant is still invested, now and then, by popular credulity, with a character uniting the *astrologer* with the astronomer? And yet shall we venture on lowering his reputation in any quarter by admitting our misgivings that, among the manifold talents and acquirements of this excellent astronomer, he may not be able to cast a nativity, or foretell what conjunction of the planets would be favorable to the British Arms? The Boards of Admiralty and Ordnance might in another age have thought that "Our Astronomical Observator" would have been quite as well employed in thus seeking to read the heavens as in rating chronometers, or in drawing boundary lines. It is, at all events, a curious link between the present and the past, that Flamsteed on his accession to Greenwich amused himself by drawing the horoscope of the observatory—an accomplishment, perhaps, within the experience of few existing astronomers. Although the link is pretty well broken, there still are persons who believe that our Astronomer Royal is not always contemplating the starry sphere in vain; and, if we are not misinformed, no long time has passed since a well-dressed female called at the observatory gate to request a hint as to the means of recovering a lost sum of money—and since somebody at Brighton despatched the liberal sum of *five shillings* in a post-office order, with a request to have his nativity cast for him in return!*

But if the magic of astronomy has all but vanished in the 19th century, we also fear that the greater part of its poetry has evaporated. If a young man has any lingering romance about astronomy, such as we spoke of in the commencement of this article, let him try the post of an ordinary assistant at Greenwich for six months, and we believe that he will be "planet-struck" no more. The regular astronomical assistants are five in number, besides Mr. Main, who is in a position of general superintendence, and immediately represents the Astronomer Royal on occasions of unavoidable absence. The work of looking through telescopes is a small part indeed of an assistant's ordinary routine; for five hours daily he is seated at his desk in the computing room, copying figures, taking out logarithms, adding and subtracting; in short, performing the most tedious repetition of the simpler rules of arithmetic, with an apparently endless iteration; and tied down all the while to the impossibility of a mistake as to what to do next, by the Procrustean bed of a "*skeleton form.*" Lest these words should appear ominous of any peculiar barbarity practised in the Greenwich computing room, we will explain their meaning in a single sentence.

It is the very essence of a system of observation that the same thing is to be repeated over and over in the very same manner, perhaps every day or several times a day; thus the taking of every transit consists of the self-same steps; and the corrections requisite for placing of the wires, the error of level and collimation, and the error of the clock, though not always *numerically* the same, enter, however, in every case, into the same part of the correction of the results. Therefore a "skeleton form" for

* The following epistolary specimen of the "march of intellect," of the year 1849, has been handed to us from the Royal Observatory: "I have been informed that there are persons at this observatory who will, by my enclosing a remittance and the time of my birth, give me to understand *who is to be my wife*. An early answer, stating all relative particulars, will greatly oblige," &c.

entering and correcting a transit observation may be *printed*, in which every step of the observation or calculation shall be pointed out, and a space left for inscribing the right figures belonging to each particular observation; while in the margin there may be directions to add or subtract, to take a logarithm, or to look in a certain table for a certain correction to be applied in a certain way; thus the operator, following the steps provided for him, can no more go astray than the visitor to the monument can quit the narrow stair which conducts him from the base to the gallery on the top. However, no pleasant view nor grateful repose awaits the computor who has toiled to the top, or rather to the bottom, of *his* column. His labor is Sisyphean; he begins just where he left off, without feeling himself either the wiser or better for what he has done. Still, like the mason of the material building within which he is engaged, he has added one brick to the edifice of human knowledge; and grow it will, though unperceived almost by himself. Nor should we omit to add, that the mechanical effort of computation, as it requires habit and dexterity to perform it speedily and correctly, so it strangely enough yet certainly does carry with it a species of quiet pleasure almost peculiar to itself, and which none but those who have voluntarily undertaken long and monotonous calculations are likely to understand. We confess to have passed many hours and days of no mean enjoyment in this mechanical kind of occupation; and few persons acquainted with the practice of accurate science but can bear testimony to the soothing calm which may be induced by the simple act of calculation.*

The Greenwich Observatory assistant is not, however, a calculator merely; nor do his duties usually end with the hours just specified. Several days a week, at least, he is in charge of an instrument, and his duty is, whilst employed in the computing room, to keep his eye on a timepiece indicating *sidereal* time, and having regard also to a list furnished to him of objects which he is required to observe, (supposing them sufficiently conspicuous to be visible by daylight through the telescope.) Five minutes before the sidereal hour corresponding to the right ascension of the object, he withdraws silently to the transit or circle room, with his metallic pencil and pocket-book in hand, in which he enters the observations; next copies it, with ink, into the "transit book," or the "circle book," as the case may be, and then quietly resumes his interrupted calculation. Of course, however, more objects fall to be observed during the night than during the day; and to regulate the night work of the assistants so as not to render it too oppressive, is one of the Astronomer Royal's indispensable, but very troublesome concerns—to exact what is right and necessary, but not to harass his subordinates with exhausting work of inconsiderable value. Each assistant set down for observing duty on a given day has, as a general rule, to watch for the objects marked as essential to be observed from 3 A. M. (or 15h. in the astronomer's language) to 3 A. M. of the following day. But he is not to sit up the whole night that he may note the place of all the stars which may be on his observing list, unless for some special reason. But he is expected (suppose him to be at the transit) to observe a sufficient number of "clock-stars" to ascertain the clock-error for that day; and to take as many observations as he can whilst waiting for the moon or a planet, or *Polaris*, (used for the verification of the adjustment of the transit instrument.) The altitude and azimuth instrument, destined specially for lunar observations off the meridian, is to be used at whatever hour the moon can be seen (by reason of clouds, &c.) between sunset and moonset, or before sunrise and after moonrise. The object being to obtain the moon's place in the parts of her orbit nearest to the sun, a good many morning watches are required every month. Mr. Airy states that this laborious duty is performed by the assistants with great fidelity and zeal.

The assistants have two rooms appropriated to their use (besides Mr. Main's room) during the intervals of night observations, but none of them reside on the premises. Fortunately for them, a track of bad weather sometimes gives a welcome holiday; whilst a course of uninterrupted sunshine (which, thanks to our climate, seldom happens) menaces the establishment with fever and apoplexy. The dogdays are the astronomers' harvest time; for (notwithstanding the apparently splendid starlight nights of winter) winter is the real holiday at Greenwich, as an inspection of the printed observations will show. The prevalence of cloudy weather is greatest in the winter and least in the summer quarter. Such is the return given by the "Greenwich Observations" for 1846, although the proportion of covered sky is not so different at different seasons, as an inspection of the printed observations (which show a great preponderance of work done in summer) would lead us to expect. On an average of the whole year 1846, during day and night, *seven tenths* of the sky are always cloudy! The night on the whole is clearer than the day. The forenoon hours are the most cloudy, the evening least so. It is wonderful on the whole, considering the proverbial

* Of mechanical aids to calculation, the following are the most important:—1. *Logarithms*, by which multiplications and divisions are reduced to additions and subtractions. 2. *Subsidiary Tables*, giving the compendious results of certain calculations which have to be frequently repeated, and which, therefore, may be done commodiously once for all. 3. The *Sliding Rule*, by which the results of multiplications and divisions are found (approximately) by mere inspection. This is used at Greenwich for many simple calculations, such as the proportional parts of clock rates for different hours. 4. Enlarged *Multiplication Table*. Crelle's useful work (2 vols. 8vo) gives the products of all numbers under 1000 by simple inspection. 5. *Wertheimber's instrument for adding* mechanically. The headwork of adding long columns is spared; the machine *carries*, and indicates the final result. This is very useful in taking meteorological means. But caution is required to see that the machine acts correctly. 6. *Skeleton Forms*, above explained. Above 100 of these have been printed for current use at Greenwich, and are numbered consecutively. This is independent of a large number used for the old planetary and lunar reductions.

badness of our sky, how few days occur altogether blank in the astronomer's year; for proof of which we again refer to the printed "Observations."

There is one remarkable peculiarity which has been found to be connected with the act of observation in astronomy when *time* is to be ascertained; it is what is called the *personal equation* of the observer. This phrase expresses the curious but well established fact that some persons, equally careful and experienced with others, *invariably* perceive a phenomenon (such as the passage of a star across the wires of the transit instrument) somewhat later in point of time; so that, in the determination of clock rates, (the most fundamental of all astronomical determinations,) such an observer would make the clock appear to be *too fast* in every instance. In a mutual comparison of personal equations, among twelve persons employed at Greenwich in 1846, ("Greenwich Observations," p. xxvii. &c.,) it was found that there was an extreme average difference of *three quarters of a second* between two of these—a quantity by no means to be safely neglected; consequently, all observations are reduced to the standard of sight of one individual arbitrarily selected. In the recent reduction of the older Greenwich observations this correction was not overlooked; and for this reason (as well as others which are obvious) every observation is entered and printed with the initials of the person making it. From observations with the altitude and azimuth instrument it is believed that, in some peculiar instances, the transit of the *limb* of a body, with a disc like the moon or a planet, is observed differently (as respects the personal equation) from that of a star.*

The same assistant is never put upon heavy observing work two nights running; nor is he expected to appear in the computing room early in the morning if he has been observing during the night. On the whole, however, the observations are lighter work than the calculations; and the former are always running ahead of the latter. It requires the utmost vigilance on the part of the director to see that the calculations are duly kept up; and for this purpose he has an occasional report made to him (which has been already referred to) of the exact state of every department of calculation or reduction. This document—which is itself a curiosity—gives a better idea of the extent of the labors of computation required to make observations useful to science than anything else could do. It extends to seven printed pages, in small folio, for astronomical calculations, and six pages for magnetism and meteorology; and these pages contain the mere heads or entries of the data and reductions. From these, and from the daily reports of what has been actually observed, the director of the observatory knows exactly what is doing in each department. Whenever, owing to a course of fine weather, to the appearance of a batch of comets, or any other event which produces over-work in the establishment, the reductions fall considerably behind, the astronomer lays on more computing power, by employing certain occasional assistants, for whose pay he is very judiciously authorized by government to expend a certain sum annually. This supplementary body has contributed very materially to the efficiency of the observatory, and has enabled it to secure many most important objects at a very small additional expense. It is easy to see that when so expensive and elaborate an institution as a National Observatory is in full and active operation, an exceedingly small addition of manual power will immensely increase the useful work which it can accomplish.

As a general rule, Sunday is a holiday: only the moon's place is observed and the time-ball dropped—operations requiring but one assistant, and for a short time. A great improvement this on the looser practice of former times, when observations of all kinds were made on Sundays.

Besides Sunday, the establishment has a monthly holiday, (as far as calculation is concerned.) This is judiciously selected at or near new moon, when our troublesome satellite cannot be observed. Each assistant has also from four to five weeks of leave during the year, at such time or times as can be arranged most conveniently for himself. The Astronomer Royal takes a like holiday; and no person in the queen's dominions deserves it better. Although an old rule of the visitors provided that he should never be more than ten days absent without leave, at no time was this probably more than a form. The Astronomer Royal and the chief assistant, however, are never absent at once.

The arrangements of the Magnetical Observatory may be inferred, generally, from what has been now stated concerning the astronomical department. The observations being perfectly regular and unintermitted day or night, independently of the state of the weather, would seem to be more harassing in that particular; and the observers were originally required to give proof of their actual attendance at the specified hours by pushing in the pin of a *tell-tale*, or *watchman's clock*—an instrument so contrived as to register the time at which the thrust has been made, and thus insure the presence and wakefulness of the party on duty: but this irksome system of control is now happily superseded by Mr. Brooke's invention of the photographic registration of the magnets. With regard to calculations and reductions, those of the magnetic and meteorological department are, on the whole, vastly inferior in point of labor and extent to the astronomical ones.* The calculations of averages are, however, very laborious.

The printing department is not the least oppressive to the observatory corps. The observations being printed in a form different from that in which they are necessarily entered into the

* See Mr. Airy's "Report to Visitors," 1849, p. 10.

* We must except, however, the determination of *absolute* horizontal intensities; but this most interesting experiment is not often made, and the results appear to be still affected by unestimated sources of error.

"skeleton forms" for the purpose of reduction, they must be copied for the press. But to avoid the effects of clerical errors, the first proof-sheets are read along with the entries in the computing books. Even the unrivalled excellence of London printers cannot supersede the labors of the observatory assistants. When so many mistakes may occur—not only from putting one figure for another, but also from error of *sign*, + or —, (although this, the most fertile, because the simplest, source of all blunders, has been reduced to a minimum through the exclusion of signs, by Mr. Airy, in every practicable case, corrections being, as a general rule, made positive) as well as from misplacing figures in columns imperfectly filled—the utmost vigilance is required, and is never at last *perfectly* successful. The *reading* of a sheet of eight quarto pages employs the time of two assistants for two mornings. It will be seen at once how much labor is consumed in the course of the year in this merely mechanical process. The number of copies printed of the ordinary observations is 350, and the expense is regulated and defrayed by the Stationery Office; it was formerly in the department of the ordnance.

We have now attempted to give a tolerably complete idea of the manner of working our *one* national and purely scientific establishment—what is the nature of its occupations, and what has been its measure of success. It is of peremptory necessity, in so populous a vicinity, that the admission to the observatory itself of the general public should be absolutely interdicted. A suspension of all business and the injury of the instruments would be the inevitable consequence of a different rule; and it appears from the records of the observatory and of the Board of Visitors, that these evils have actually occurred. At present, therefore, no one not officially connected with the public service, and not himself a man of recognized scientific character, can be admitted into the observatory, and these only by a suitable introduction to the Astronomer Royal. Curiosity is naturally enhanced when its gratification is difficult; and it is for this reason that we have tried to give some idea of Greenwich Observatory to those who may not have an opportunity of visiting it themselves; and to render a visit more instructive to those who may be so privileged.

We have said that the instrumental department is now, even at the time we write, undergoing a great, in some measure even a radical, change. Mr. Airy is trying the great experiment of using a more powerful telescope than has yet been applied to divided circular instruments of the highest accuracy: and he is likewise combining the transit and meridian circle into one instrument.* The result of the combination is a telescope eight inches aperture and twelve feet long, which will be connected with a vertical circle six feet in diameter, the whole being framed in cast iron and mounted upon two independent piers furnished with Y's by means of a transverse axis of great strength. It is not intended, however, to be reversed like a transit instrument, but the line of collimation will be adjusted by means of two fixed telescopes. It will be the joint work of Messrs. Ransome and May of Ipswich, and of Mr. Simms of London. We have already stated that a new zenith tube on an original construction is in progress. It is not hoped that results will be obtained with the transit circle very much superior to those obtained from the excellent instruments hitherto in use; but the state of science generally, and particularly the multitude of small planets recently discovered, call for the application of a higher power, and of telescopes with a greater command of light than those which have heretofore been used. The employment of an enlarged telescope requires the remodelling of every part of the apparatus, so as to support the increased weight.

In drawing this lengthened article to a conclusion, we are bound to make explicit acknowledgments to the Astronomer Royal for the aid he has given us in obtaining the minutest information connected with every part of the observatory and its management; without which information, it is needless to say, that our intended object could not have been fulfilled.* And while we express our admiration of the singular combination of qualities which he possesses for the management of a National Observatory, we cannot but add our sincere hope, both for his own sake and for the public benefit, that his life and vigor may be long preserved.

Postscript.—Since this article was written and put in type, we have had the pleasure of seeing a volume of "Popular Lectures on Astronomy," by Mr. Airy, printed from short-hand notes taken at Ipswich, where the lectures were delivered, in 1848, to a numerous audience of a mixed character. They contain a very clear and popular exposition of the more practical parts of astronomy, couched in plain, precise, and highly graphic language. They are published in a neat form, with clear illustrative plates, for behoof of the Ipswich Museum. Had they been sooner in our hands, we should not have failed to refer frequently to them in the course of these pages. But we are happy to be able to recommend to our readers a work which contains, in so elementary a shape, so large an amount of valuable and accurate information.

We hear from good authority, that it is the intention of the Admiralty to revise the present regulations for the uniform of the Royal Navy, with the view of reducing the costly expenditure of the junior officers. It is said that epaulettes are to be altogether abolished, and it is a question whether the antiquated cocked-hat will be retained for use on board ship.—*United Service Gazette.*

* The plan of a reversible transit circle is due to Römer, who set one up in 1690. After having been abandoned for more than a century, it is now adopted in the finest modern observatories.

* Our thanks are also due to Mr. Main, the assistant-in-chief; and to Mr. Glaisher, the principal assistant in the Magnetic Department, for valuable information politely communicated by them.

From the Spectator.

LIFE AND CORRESPONDENCE OF DR. ANDREW COMBE.*

The distinguishing characteristic of the late Andrew Combe, was the power of popularly expounding scientific principles, and applying them to a broad, distinct, and useful purpose. Original in the sense of discovery he was not; he made no great discovery like Harvey's on the blood, or like Bell's on the nerves. We believe he was the first in the order of date who called attention to hygiène in a large sense—that is to say, the preservation of health, the prevention of disease, and the encouragement of cure, by attending to the due performance of the general functions of the body, and to ventilation, exercise, and regimen. Strictly speaking, these principles had never been altogether lost sight of. There were always men who practised cleanliness and temperance, and took the "constitutional" walk; as there have always been writers both lay and professional, both in prose and verse, to enforce the canon that "cleanliness is next to godliness," and to inculcate the truth that "health consists with temperance alone." The excellence of Andrew Combe consisted not in the *discovery* of these rules, but in the systematic manner in which he enforced and illustrated them, by a popular exposition of the physiological why and wherefore. The public attention, however, since the time of Cook and Howard, had been so directed to this subject, that it was growing in many minds, and would perhaps have reached its present importance without Andrew Combe. Within twelve months of the appearance of *Physiology applied to Health and Education*, Southwood Smith published his *Philosophy of Health*. Chadwick was already laboring in the same field, though the results were not promulgated till two or three years afterwards; and the numerous lectures, &c., that almost immediately appeared both in England and America, show how extensively the subject had been working; for they were too sound and able for mere trading imitators. But if Andrew Combe might have had competitors in priority, he had none in popular attractiveness; and his three principal publications on Physiology, Digestion, and the Management of Infancy, stand alone, though in different degrees, for their popular exposition of medical, physiological, and hygiènic science.

To have aided in popularizing the laws of health and advancing the science of hygiène, is a very great merit; and the individual is entitled to greater praise when he had himself to pertinaciously struggle with ill health. The merit is not, however, of the rarest order; nor does it inspire so much biographical interest as is felt in some cases. The great poet, the great hero, the great philosopher, excite so much interest that trifles unimportant in themselves become attractive from their connection with the person; though if these details are numerous there would be a limit to their biographical use, even in the case of Shakspeare. With the great majority of lives, everything that is not of some biographical consequence, or of some strong character in itself, is out of place, fatiguing the attention and flattening the effect. From not attending to this rule, Mr. George Combe has somewhat overlaid the biography; very naturally, indeed, for a brother, and a brother whose steady kindness to Andrew, while he needed it, took a paternal character; but this reason for the error does not produce much countervailing effect upon the reader. In an anxiety to do full justice to his subject, which from the preface seems to have almost reached a morbid feeling, Mr. Combe has crowded his volume with passages from printed or published productions of Andrew, or with letters of the nature of essays and disquisitions, and sometimes on topics where he had already given the world the pith of his opinion in a more matured form. The annual accounts of his brother's health and topics connected therewith, to which some of his friends to whom he submitted a portion of the volume objected, are certainly too detailed; and the distinction between what is essential to the life and the case, and what is insignificant or accidental, is not sufficiently observed. But the ill-health of Dr. Combe, the manner in which he wrestled with it, the effect it doubtless had in directing his attention to the hygiènic principles on which his celebrity was founded, and the curious manner in which he managed to prolong his life, were so strikingly biographical, that fulness here was necessary; though more care in the selection of information might have been desirable. The phrenological matter is the greatest drawback to general pleasure. Phrenology does not seem to us to have done so much for the formation of Andrew Combe's intellectual and medical character as he and his brother George suppose; but his zeal in the cause introduced him to the public, by inducing him to write more than he otherwise might have done; while, by connecting him with a busy, zealous, energetic sect, his name was more noised abroad than it would have been had he continued in the quiet catholicism of science. The objection, however, is not to phrenology, but to the mode in which it is managed. Lucan "stops his narrative for a wise remark;" George Combe suspends his biography for a disquisition or application of phrenology; and he does it in that strange tongue which has all along exposed the new science to the ridicule of scoffers.

Andrew Combe was born in 1797, at Edinburgh, where his father carried on the business of a brewer. He first went to a private school, then to the High School, and lastly to the college of his own romantic town; without learning much either in English, Latin, Greek, or the mathematics; all which is duly accounted for by his biographer on phrenological principles. In his fifteenth year, it was deemed proper that Andrew

* The Life and Correspondence of Andrew Combe, M. D., Fellow of the Royal College of Physicians of Edinburgh; one of the Physicians in Ordinary, in Scotland, to the Queen, &c. &c. By George Combe. Published by Longman and Co.; and by Maclachlan and Stewart, Edinburgh.

should choose a vocation. The choice was left to himself; but he preferred illustrating the grammatical paradox that two negatives make an affirmative; replying to all questions, "I'll *no* be naething." The ears of the family, unaccustomed to such refinements of speech, dropped the first negative and were puzzled. His father interpreted it into an approval of his own choice of the medical profession, and proceeded to make an arrangement with Mr. Johnston, then an eminent general practitioner in Edinburgh.

The 9th day of April, 1812, was fixed for his entry to Mr. Johnston's establishment, and he was desired to dress himself for the occasion. His father was prepared to accompany him and introduce him. Andrew was sullen, did nothing, and said nothing. His brother George, who was nine years older than himself, and had reached to manhood, still lived in his father's house. He saw with regret this unpleasant state of affairs, and took an earnest and active part in endeavoring to induce Andrew to enter on his profession. His father assured Andrew, that if he would name any other vocation which he preferred, he should not be asked to move one step in the intended career; but no answer was returned. George solicited and obtained his father's solemn promise, which was never known to be broken, that if Andrew would make trial of Mr. Johnston's establishment for one day, he should not be desired to return if he disliked it. Still no answer was given. As an appointment for ten o'clock had been made with Mr. Johnston, and his time was valuable, it became necessary either to resort to compulsion, or to abandon the arrangement altogether. It was, however, against all rule in the family to permit evasion of what was regarded as a duty, merely because the thing to be done was disagreeable; and, as the kindest assurances had been given, and no reason assigned for opposition, force was at last resorted to. An attempt was made to substitute Andrew's best coat and vest for the house-garments in which he was dressed, and he resisted; but his resistance was overcome. A new consultation was now held as to what was to be done; and again it was resolved that Andrew should not be allowed to conquer, seeing that he still assigned no reason for his resistance. He was therefore lifted from the ground; he refused to stand; but his father supported one shoulder, George carried the other, and his younger brother James pushed him on behind; and in this fashion he was carried from the house, through the brewery, and several hundred yards along the high-road, before he placed a foot on the ground. His elder brother John, observing what was passing, anxiously inquired, "What's the matter?" James replied, "We are taking Andrew to the doctor."—"To the doctor!—what's the matter with him? is he ill?" James—"Oh, not at all: we are taking him to *make* him a doctor." At last Andrew's sense of shame prevailed, and he walked quietly. His father and George accompanied him to Mr. Johnston's house. Andrew was introduced and received, and his father left him. George inquired what had passed in Mr. Johnston's presence. "Nothing particular," replied his father; "only my conscience smote me when Mr. Johnston 'hoped that Andrew had come quite willingly!' I replied, that I had given him a solemn promise that if he did not like the profession after a trial, he should be at liberty to leave it."—"Quite right," said Mr. Johnston; and Andrew was conducted to the laboratory.

Andrew returned to Mr. Johnston's next morning without being asked to do so; and to the day of his death he was fond of his profession.

He subsequently stated, as a reason for this conduct, that he wanted a holyday before beginning to dispense the medicines for Dr. Johnston's patients; to acquire which mechanical knack, was nearly all he picked up under that gentleman, except a little workhouse practice towards the close of his time.

The medical education of Andrew Combe was really begun in the hospital and at the lectures of Edinburgh, and finally completed at Paris; whither he went in 1817, and remained till 1819. During the period of student life, he became a convert to phrenology; improved his neglected education; and made a tour through Switzerland. Symptoms of consumption in his constitution now became manifest. On his return to Scotland, he remained with his friends long enough to assist in founding the Phrenological Society; but his health was two precarious to justify his entering into practice. For two years he was a confirmed invalid; travelling about with the seasons in search of a climate that suited him, wintering once at Leghorn and once at Marseilles. In 1823 his health was so much improved that he began practice in Edinburgh.

From this period to his death, in 1847, the life of Dr. Combe was a long struggle with disease, relieved by a few years' interval of health. His shrewdness, his sense, his conscientious attention, coupled perhaps with a local literary celebrity as a medico-phrenological writer in the Journal, gradually introduced him into practice. But in 1831 severe pulmonary affection again manifested itself. He had again to winter in Italy; and it was some years before he resumed the practice of his profession, if indeed he can be said ever to have renewed it. He was tolerably well as long as he avoided exposure; but cold, exertion, or indeed any unfavorable circumstances, threw him back. The reputation he acquired by his medical works brought patients about him, who submitted to such conditions as his complaint rendered necessary; and perhaps his appointment in 1836 as physician to the King of the Belgians was not without influence in this respect. The appointment, however, was rather hygiènic than medical; for Dr. Combe feared to live in Brussels when he got there, and only occasionally visited it to inspect and advise with the royal family touching their health and the site and condition of their palaces. In 1838, he was appointed to the honorary office of physician extraordinary to the queen in Scotland; and by dint of management, contrived to creep on till 1842, when his health finally gave way. The two next winters he spent in Madeira, passing the summers in gentle excursions; but after 1844 it was deemed better that he should winter in Edinburgh, with an artificial atmosphere and all the appliances of modern skill, and among his friends, rather than be subjected to the discomfort

of travelling and the absence of home comforts, when convalescence was out of the question, and death likely to occur at any time. He held on till the autumn of 1847, when diarrhœa set in and carried him off rapidly.

During these sixteen years of severe illness and imminent death, Dr. Combe produced his best works; perhaps, indeed, his illness was a cause of them. He accumulated his materials by slow observation, and slowly wrought them up; in full health and full practice he might have continued to throw off an article for the Phrenological Journal or some friend's Review, but he could hardly have found time to produce volumes upon the following mode of composition, as he describes it in a letter to his friend Sir James Clark.

You need not fear my hurting myself with writing; and, by the way, you amuse me by envying my facility in writing. Know, then, that many a time and oft I have envied you in this respect. I have no such facility in composing, especially since my infirm health. Witness the fact that my review of your book took me upwards of three weeks, laying aside all other composition; and such is the proportion of time to all other subjects, even though I am familiar with them. You have probably formed this notion from my book on digestion having appeared in about a year from its announcement; but, in reality, it and my former volume are the work of years. So long ago as 1824, I had begun to write the latter, (the Physiology,) and threw it aside in despair of making it intelligible. It happened, however, that from an early period I had many consultations and advices to give in writing to patients who lived much in the country, or who called for me while passing a short time in Edinburgh, and also to strangers whom I never saw. For the sake of easy reference, as well as to preserve a record, I at last got a copying-machine, and for six years past have taken a copy by it of all my business letters; and thus there is scarcely a remark in my whole writings that does not directly or indirectly come out of that correspondence, and consequently out of actual observation; and it is this practical quality, I believe, which makes my writings interest so many readers. Here, too, you will observe, I have materials for writing which save me much trouble; and it was only from the frequent assurances of my correspondents that what I said was level to their comprehensions, and of much interest to their minds, that at length I ventured to prepare and publish the first volume.

Dr. Combe seems to have thought that his stamina was injured by the physical and mental training he underwent at home; the family being strict both in the domestic and religious discipline. This opinion is supported by George; who thus describes a family Sunday—a very common one in Scotland half a century ago.

To complete the picture of domestic life at Livingstone's Yards, it remains only to mention the Sunday's occupations and discipline. The gate of the brewery was locked, and all except the most necessary work was suspended. The children rose at eight, breakfasted at nine, and were taken to the West Church at eleven. The forenoon's service lasted till one. There was a lunch between one and two. The afternoon's service lasted from two till four. They then dined; and after dinner portions of Psalms and the Shorter Catechism with the "Proofs" were prescribed to be learned by heart. After these had been repeated, tea was served. Next the children sat round a table and read the Bible aloud, each a verse in turn, till a chapter for every reader had been completed. After this, sermons or other pious works were read till nine o'clock, when supper was served; after which all retired to rest. Jaded and exhausted in brain and body as the children were by the performance of heavy tasks at school during six days in the week, these Sundays shone no days of rest to them.

We have spoken of the biography as a whole, and as a work of art. Viewed merely as a book, it abounds in matter and information of various kinds, and in passing pictures of society from the pens of both brothers. Subjected to a searching revisal, it would form a very capital work; as the valuable portions which are now overlaid by the extraneous matter would then stand out with full effect. These extra-biographical passages consist of pictures of men and things at home and abroad; of many travelling sketches in Andrew Combe's letters from foreign parts; in sound medical advice and opinions; and in many matters too diversified to class. Such is this story of the use of phrenological science.

In the course of Andrew's residence in Paris, M. S—— (a foreign friend) introduced to his daughter a lover whom he regarded as worthy to receive her hand, and to inherit his fortune; but, unfortunately for the old gentleman's choice, the young lady had already found a lover for herself, to whom she was warmly attached; and as she had taken her mother into her confidence, she now appealed to her for support. The mother, after seeing both suitors, greatly preferred Eugenie's choice; but the father's friend held a superior social position to that of his rival, and was therefore strongly supported by the father.

During Dr. Combe's visits to the family they had frequently been struck by the acute and correct descriptions which, with the aid of phrenology, he gave them of the talents and dispositions of individuals whom he met in their circle, and whom they knew intimately; and as both parents loved Eugenie dearly and aimed only at her happiness, they took him into their counsels, and asked him to examine the heads of the two lovers, and to advise them honestly and confidentially which was the superior man. He did so and reported that the father's friend was by nature selfish, cunning, and ambitious; while Eugenie's choice, in whom a good development of the intellectual was united to a large development of the moral organs, evidently was the higher natural character of the two. The father having, it is believed, subsequently discovered the true character of his candidate, yielded, and in the course of time Eugenie and her lover were married.

The following is from a letter to one of the doctor's sisters-in-law, an American and red-hot republican, who had favored him with a liberty letter.

I believe a republican form of government to be that intended for man in the maturity of his civilization; but I should as soon attempt to put the garments of manhood on the child and the boy, as desiderate a republic for any existing European nation in its present state of advancement. It would be a black day for Britain were the masses, with their present qualifications and habits, made the depositories of extreme power; and, whatever may be the course of events in America, I trust Providence in its wrath will not afflict us with a republic till we are better prepared for the high and right exercise of its powers and privileges. In your eloquent denunciation of kings, nobles, and dignified clergy, you are far too exclusive. I do not venerate mere rank any more than you do, but neither can I regard its possessors as worse than any aggregate number of the "sovereign people." Nay, I am so heterodox as to believe, that if you would put the same power into the hands of the said sovereign people, the latter would abuse it in a still more reckless and tyrannical fashion; just because, not being used to it, they would fulfil the old adage, "Put a beggar on horseback, and he will ride to the devil."

I confess, moreover, that even your animated description of the pure independent spirit and unbiassed judgment of a free-born American citizen, does not in the least excite my envy; for every American newspaper which I have ever opened placed before me ample evidence of the existence and activity of the same evil and selfish passions on your side of the water which we perceive and deplore here; and if ever you come over to the land of cakes, I dare say you will not discover that your liberty of speech is in any way abridged, even although we have a queen instead a president for our executive. But that kings are really of more use than you republicans imagine, I can bear ocular evidence. During my late visit to Brussels, I lived fourteen days in the palace, and spent on an average one and a half or two hours daily with their majesties or the children; visiting the one after the other, I mean. During that time, the king was engaged in mental labor nearly eight hours a day; and on my remonstrating, as he was infirm in his health, he said, "It is truth; but what can I do? the business *must* be done." The question between Belgium and Holland was then in agitation; and the universal feeling in the country was, that there was not a man in it except the king who united the knowledge, prudence, firmness, tact, and energy, required to effect a settlement; and that, consequently, the safety of Belgium and the prevention of a general war depended on the health, life, and character of that one man. Hurl him from his throne, and you inflict misery on millions now prosperous and happy. This was the testimony not only of adherents but of political opponents; and as I purposely travelled through the greater part of Belgium, I was struck with the great advance made in two short years, and with the warmth of devotion generally felt for him.

From the Spectator.

CATHCART ON THE RUSSIAN AND GERMAN CAMPAIGNS OF 1812 AND 1813.*

In 1812, Colonel Cathcart, then in his nineteenth year, and a Lieutenant of Dragoons, accompanied his father, Lord Cathcart, to St. Petersburg, whither his lordship had gone as the representative of Great Britain, when Napoleon's invasion induced the Emperor Alexander to receive a British ambassador. During the Russian campaign, Lord Cathcart remained in the capital with the emperor; when Alexander took the field in the spring, the ambassador accompanied him, and was followed by his son, the lieutenant. "From that time to the capitulation of Paris, in 1814, he was constantly with the army, and had an opportunity of seeing and hearing what was going on during the following campaigns, as well as of witnessing much of their interesting and instructive details: thus he had the good fortune to see eight general actions lost and won, in which Napoleon commanded in person."

This personal opportunity of observation does not apply to the Russian campaign; of which Colonel Cathcart gives a summary account as an introduction to the war of liberation in Germany. In the mode of treatment, however, there is no difference between the two narratives. Colonel Cathcart's object is a military commentary pointing out the military causes of success or failure, not a redcoated littérateur's set of sketches, where the picturesque in mass and the gallant in individuals are the writer's subjects. Anecdotes and incidental accessories are occasionally noticed, when they lie directly in the way; and the freshness of personal knowledge pervades the descriptions both natural and military; but professional criticism and mathematical demonstration are the characteristics of the work. The essential difference in the various arms of the service will enforce some difference in the description of their action, but "the pride, pomp, and circumstance of glorious war" are disregarded, or if mentioned at all it is only for the force that lurks under them. The campaign is considered as a game or a problem. The general scheme of the whole is described and criticized; the successive moves are subjected to a similiar consideration; their effect or that of any accident is pointed out; and the reader is conducted to the secundum-artem conclusion, with the necessary allowances for luck. Hence, mere fighting, which seems to the uninitiated the all-in-all of war, occupies an apparently small space; while the strategy, the preparations, and the muster-rolls, are treated at greater length than the victory itself, which for romance-readers will seem lost and won too easily. Subordinate affairs, partisan warfare, and individual actions, that furnish so much of the stirring and picturesque, are omitted altogether, unless in the rare case of exemplifying some principle of tactics; even the campaigns of collateral armies are only noticed for their influence on the main result.

The effect of this mode of composition is not dryness, as might be supposed, but clearness. Cause and consequence, which in rhetorical and descriptive history are overwhelmed by words, or somewhat lost sight of because perhaps the historian may not clearly perceive them himself, are

* Commentaries on the War in Russia and Germany in 1812 and 1813. By Colonel the Honorable George Cathcart. With Plans and Diagrams. Murray.

continually present to the reader in Colonel Cathcart's Commentaries. He is taken behind the scenes, and shown the whole machinery, so that he can trace the progress of the campaign as an intelligent operation, barring blunder or luck—which in fact did turn the scale in favor of the allies; their delay in attacking Dresden causing their defeat, and the victory at Culm over Vandamme not only saving them from fatal disaster, but restoring their affairs. This clearness is the more valuable because the campaign of 1813 has not excited so much attention as it deserves; or its complexity when noticed has given rise to a kindred complexity of narrative. The unity of the Russian campaign, and the vastness of its catastrophe, fill the mind; as do the rapidity, the singleness, and the immediate results of the campaign of Waterloo. The liberating war in Germany, as Colonel Cathcart observes, is less regarded, although in a military sense more worthy of study, as it was in reality successful through superior strategy on the part of the allies; Napoleon having replaced his Russian losses in a manner almost miraculous, so as to be at the outset superior in force. It should, however, have been more distinctly stated that the prestige of Napoleon's name was shaken; that his new levies had not the experience or confidence of his lost veterans; and that the long tyrannies of the French in Germany had entirely reversed the political and moral aspects of the war. Napoleon in 1813 was in the position of the old aristocratical armies in 1793, whereas the despotic sovereigns represented the beau idéal of the French Revolution and its hopes. Either from the nature of his mind or a long course of miraculous good fortune, Bonaparte was ill qualified to play a losing or cautious game, and he could scarcely shut his eyes to the treachery by which he was surrounded. The military force that Austria brought to the allies was not much, but she gave great territorial facilities; and her conduct, before she joined them, was calculated to cause uncertainty by infusing doubt. Neither was Napoleon so young as in his earlier campaigns. It is true, his years were only forty-four; but the vivacity and rashness of youth were past, and they seem to have been necessary to the thorough carrying out of Napoleon's tactics.

Besides the personal knowledge already spoken of, Colonel Cathcart has carefully studied the statistics and other documents connected with the campaign that have since been published, and brought much thought to bear upon the subject, as if the wonderful events he witnessed in early youth had formed a theme for the meditation of his life. He seems also to have carefully studied the military characteristics of the different continental nations, as well as the principles of war. He has consequently infused into his book the spirit of a wide and varied professional knowledge, which is conveyed in a plain and concise style. The following exposition of the leading principles of strategy to illustrate the war in Germany after the battle of Dresden, may be adduced as an example of Colonel Cathcart's professional manner.

The author is anxious at this particular period to invite the attention of the reader to the first principles of strategy, which, like the elements of all sciences, are, when duly recognized, clear and self-evident truths. In point of theory, the admirable work of the Archduke Charles, or for practical illustrations, the base of Torres Vedras covering Lisbon, and the glorious achievements which emanated invariably from it, will be consulted and considered with advantage by those who desire a thorough knowledge of this science; but, for the present purpose, it will suffice to point out that the elements may be reduced to the three following postulates.

First. A base of operations; being that locality from which the supplies of the army are to be furnished.

Secondly. The objective; being an object or goal, the attainment of which must render the campaign decisive, and to which, therefore, all movements must have reference.

Thirdly. The line of operations; being the most favorable route or communication leading from the base to the decisive point or objective.

It follows, of course, that the base of the defending army must either be the decisive point itself that is menaced by the opposite party, or some other point covering it, and that the line of operations must be common to both.

Bearing these principles in mind, it will be found in the history of modern warfare, conducted by regular armies on both sides, that in every instance where they have been lost sight of or departed from, (and there are many,) victory has led to no good result, and defeat has proved an irretrievable disaster; whereas, where they have been duly attended to, each success has become a point gained in the progress of the campaign; and though partial failures may have retarded operations and even occasioned retreats, yet such failures have not proved decisive.

In the following chapter it will be found that Napoleon, through obstinacy, like a headstrong gambler playing a losing game, contrary to his own experience and former practice, determined to cling to Dresden, and make it a centre of operations. Under existing circumstances, this was a wilful departure from the principles of strategy; for by doing so he left the line of communication with his true base, the Rhine, at the mercy of his powerful enemy.

The author is the more desirous of calling attention to this subject, because a popular and in most cases accurate writer of general history has characterized this policy of Napoleon's as profoundly conceived, and most ably carried into effect. He trusts that the events recorded in this book alone will suffice to justify the true principles of strategy, and prove the worthlessness of the miscalled "profound conception" of operations with large armies radiating from an insulated centre, without reference to the true base and line of communication.

* * * * *

After the battle of Dresden, Napoleon, by no means satisfied with the conduct of Oudinot in the campaign of Gross Beeren, sent Marshal Ney to supersede him in the chief command. With a view to his altered circumstances, he had then formed the plan of making Dresden a common centre for his armies; acting from which, instead of from a more orthodox base, he might bring concentrated and superior forces to bear against each of his three separate opponents in succession, and

thus he hoped to beat them in detail—a fault in strategy of which he decidedly paid the penalty.

This principle of military action, when a general places himself with collected forces in the centre of a hostile circle, can only be justified in the case of small armies in desperate circumstances, such as in civil war, where no other strategic base than the metropolis can be found. The possession of this by either party may then be decisive; and if the foe can be brought to battle without delay, a victory may be attended with a favorable and conclusive result. But in Napoleon's case, his subsequent failures will serve as sufficient commentary on the uncertainty of that unscientific mode of warfare, and the danger that attends it in the operations of large armies.

Although the greater part of the book consists of matters treated in this scientific way, there are incidental passages of a more general kind, relieving the science of war by more natural touches. This is the second morning of Bautzen.

It was a fine summer morning on the 21st of May; all was still, and even the sound of an occasional musket-shot, discharged along the distant line of advanced sentries, was scarcely to be heard. At daybreak we were in the field, and the Emperor of Russia and King of Prussia were already on a height in front of the centre.

However, the enemy were in motion, and appeared to be assembling in force on the rising ground immediately in front of Bautzen, menacing our left or centre. Napoleon himself was very distinctly to be seen, accompanied by his staff, and apparently superintending the assembly of his troops. Whilst his preparations were in progress, he dismounted and walked about with his hands behind his back in conversation with officers of his suite. All our glasses were directed towards him; and one belonging to Lord Cathcart, which proved to be the best there, was in great request, and was employed on this occasion by the Emperor Alexander and the King of Prussia.

Although the two hostile staffs were not out of the range of each other's artillery, and though Napoleon himself was quite within the reach of the Russian batteries, the allies were too courteous to disturb his meditations by a shot. Berthier and others were recognized; but one person in the group, with whom Napoleon seemed to have much conversation, and while discoursing with whom he frequently consulted his map, puzzled the allied head-quarters very much: he was in a bright yellow uniform; and after various conjectures it was agreed that it could be no other than Murat, who delighted in dress, and was occasionally to be seen in all sorts of costumes. This was important, if the belief were well founded; because the presence of Murat argued that the Italian levies were in a state of forwardness; besides that, the personal exertions to be expected from his well-known activity and skill as a cavalry officer would require increased vigilance on our side. This belief was entertained till much later in the day, when it was ascertained from prisoners or deserters that the man in yellow was no other than a Saxon postilion, employed as a guide, of whom Napoleon was asking the names of the different villages.

The following exhibits Alexander after the retreat from Lutzen.

The Emperor of Russia passed the night of the battle at Pegau, whither his briteka containing his papers and camp-bed had been brought; and, after having been twenty hours on horseback, Lord Cathcart and his staff found the bare floor of a cottage so comfortable a couch, without even the luxury of straw, that no one seemed in any hurry to rise, when we were informed, soon after daylight, that his imperial majesty was about to mount and depart, and that the enemy were approaching to dislodge us. The emperor slowly rode some miles towards the rear, along the Altenburg road, conversing with Lord Cathcart about the battle: he laid great stress upon the report of the commandant of the artillery as to the want of ammunition, which he assigned as the principal reason for not renewing the action; he spoke of the result as a victory gained on our side; and it was afterwards the fashion in the army to consider it as such, though not perhaps a victory so important in its consequences, or so decisive, as could have been wished. At length the emperor observed that he did not like to be seen riding fast to the rear, and that it was now necessary for him to go to Dresden with all expedition, and prepare for ulterior operations; he then entered his little travelling-carriage which was drawn by relays of Cossack horses, and proceeded by Altenburg to Penig.

From the Spectator.

THE CLIMATE AND METEOROLOGY OF MADEIRA.*

The late Dr. J. A. Mason, the inventor of the hygrometer which bears his name, was ordered to Nice, by Sir James Clark, for a pulmonary affection. During the journey, a relation was attacked by a brain fever, at Dieppe, and Dr. Mason sedulously attended him till his convalescence. This delay rendered Nice no longer advisable as a residence, on account of the season; and a communication from Sir James Clark recommended Madeira.

To Madeira, therefore, Dr. Mason went; and he may be said to have hastened his death by the ardor with which he engaged in observations on the climate, and on the completion of some theories founded on the facts he had collected. After residing nearly two years at Madeira, more occupied with his pursuit than his health, Dr. Mason at length embarked for Nice; and reached it to die. Scarcely had he arrived there and sat down to dinner, "when he was compelled to exchange the table for his bed;" which he never left again—he expired within a fortnight.

The work composed under such circumstances became the property of the widow's second husband; and it is now published under the superin-

* A Treatise on the climate and Meteorology of Madeira. By the late J. A. Mason, M. D., inventor of Mason's Hygrometer. Edited by James Sheridan Knowles. To which are attached, a Review of the State of Agriculture and of the Tenure of Land, by George Peacock, D. D., F. R. S., &c., Dean of Ely, and Lowndean Professor of Astronomy in the University of Cambridge; and an Historical and Descriptive Account of the Islands, and Guide to Visitors, by John Driver, Consul for Greece, Madeira. Published by Churchill; and Deighton and Laughton, Liverpool.

tendence of Mr. Sheridan Knowles. To Dr. Mason's tabular facts in relation to the temperature, moisture, and other features of the climate, and the theories he has founded thereupon, are added some further thermometric and hygrometric observations made by Mr. M'Euen, of Philadelphia, and by Mr. Young of London, in 1848–1849; an essay on the state of agriculture and on the tenure of land in Madeira, by Dr. Peacock, Dean of Ely; and an historical and descriptive account of the island, with various practical information useful to visitants, by Mr. Driver. Both Dr. Peacock's and Mr. Driver's sections contain a good deal of useful and real information; but the most important and interesting part of the volume is the work of Dr. Mason; not only for the view it presents of the climate of Madeira, but for the theories it advances on disease in relation to climate. Succinctly stated, these are the following.

It is known by the experiments of various chemical philosophers, that the lungs and the skin act very extensively as excreting organs; Lavoisier and Sequin estimated the average loss by perspiration from the skin and lungs in twenty-four hours at two pounds thirteen ounces; of which one pound fourteen ounces is dissipated by the skin, and fifteen ounces by the lungs—or in the proportion of two to one. In a dry and cool or cold atmosphere, this excretion goes on very favorably with a person in good health; the lungs do their work well and amply; the perspiration from the skin is insensible. In a hot, damp atmosphere, fully saturated with moisture, the lungs can give off little vapor, because the air is already charged with as much or nearly as much as it can receive. A heavier duty is thrown upon the skin; but, from the state of the atmosphere, the excretion must more or less take the form of sweat, which is a vital action, not like insensible perspiration a chemical action, and is exhaustive of vital power, besides the risk of catching cold. A cold, dry atmosphere, however, may be too cold for invalids; because the air in the lungs being raised to a uniform temperature, (whatever the atmospheric temperature may be,) by means of heat abstracted from the body, a feeble constitution cannot restore the animal heat so fast as it is abstracted. Of course this statement is made broadly; there are intermediate stages, modifications, and explanations of detail, that must be sought in the volume; but two principal conclusions are to be drawn from Dr. Mason's view. 1. That it is of the last importance, in recommending a change of climate, to consider both the nature of the climate and the constitution of the patient; otherwise more harm than good will be done. 2. That it would be of great advantage to institute a series of hygrometric observations at various places, in addition to those made with the thermometer and barometer, in order to establish their relative atmospheric heat and moisture.

Tried by this test, instituted by Dr. Mason himself, Madeira is pronounced a bad climate for any one to whom a dry atmosphere is indicated. London and its vicinity, and the ports in the British Channel, moist as our climate is, are drier than Madeira. This opinion is supported by a variety of specific facts, which would be interesting chiefly to the scientific reader; and illustrated by the following accounts.

In the last place, in order to prove the dampness of the climate, I may instance the impossibility of keeping iron, in any form, from being rapidly oxydized. The different powders, such as opium, squills, &c., soon lose their pulverulent form, and become firmly united into a solid mass; various neutral salts rapidly deliquesce; gloves, shoes, &c., soon become covered with various species of cryptogamous plant; silks become spotted, and unfit for use; pianofortes frequently require retuning; and the screws of various other instruments, as violins, guitars, &c., become so tight as to be almost immovable. In fact, it would be impossible for vegetation to flourish, were not the atmosphere almost saturated with moisture; as frequently, during the fine season, there is scarcely a shower of rain for three, four, and sometimes even six months in succession.

The injurious effects of Madeira to many patients are also illustrated by the phenomena of the "Leste," a dry wind, which, blowing across the great African desert, reaches Madeira bringing with it particles of dust, and a *parching* influence, little modified by the ocean it has passed over.

The condition of the atmosphere during a Leste is by no means too dry for a great proportion of invalids sent to this island; indeed, it is only during its prevalence that they feel the cheerful influence of climate, and express themselves strongly that, could they live in a perpetual mild Leste, or in other words a warm and equally dry atmosphere, they would soon recover. It almost amounts to a proverb amongst the residents of the island, that those with whom the Leste agrees seldom recover; and accordingly such cases are set down as the most unfavorable. Now to a reflecting mind it must be obvious that all those individuals with whom the Leste agrees ought not to have been sent to Madeira; as, under the most advantageous circumstances, they will only enjoy perhaps a dozen days calculated to give them a chance of ameliorating their condition; for, the general conditions of the atmosphere being directly the reverse of what they require, they of necessity rapidly get worse, or do not make the slightest improvement. This is not owing to the malignity of the case itself, but to the individual being placed under conditions the most unlikely to promise any benefit from the effects of climate. From my own observation I should say that, as soon as any invalid finds that he becomes better during a Leste, it would be advisable for him to seek a drier climate without delay. On the other hand, invalids who feel oppressed and languid during its influence, are those who are likely to derive benefit from a residence at Madeira, and may naturally hope to be reinstated in health as far as their organic condition will allow of being brought into a favorable state.

On the other hand, we may naturally infer that those invalids who have visited the coast of the Mediterranean for the sake of health, and who find the sirocco agreeable to them, had better quit its shores and proceed to Madeira, where they will

find a mild and permanent condition of atmosphere similar to the sirocco which visits Naples and the South of Italy, being essentially warm and moist.

In addition to the before-mentioned sources of evil to particular constitutions, there are in Madeira general causes of ill health, from malaria when the purifying winds cease to blow, and from the dirt and disagreeables of the people; which, however, are perhaps less now than when Dr. Mason wrote, in 1834–'35.

In order to elucidate more clearly the equality of the temperature, it will be necessary to say a few words on the land and sea breezes, which are the N. E. and S. W.; I must premise, however, that my observations on this subject refer only to the district in which they were made, and to the precise time of their occurrence.

It is upon the regularity of those winds that the salubrity of the place depends; for, whenever there is any remarkable or continued variation of such currents, the health of the inhabitants suffers more or less severely; principally, as I imagine, from the surrounding medium being charged with the effluvia of animal as well as vegetable substance in a state of putrefaction, which, on account of the uniformly high temperature and the humidity of the climate, takes place with great rapidity. No measures being employed to prevent or remove the accumulation of refuse arising from the assemblage of twenty-five thousand people, the local atmosphere is soon surcharged with impurity in the absence of land and sea breezes; the latter of which considerably dilutes the poison, while the former conveys it over the immense bed of the ocean, rendering it comparatively harmless in its effects on the human organization. The numerous tanks, kept to irrigate the gardens during the summer, and the water in which is seldom renewed more than once a month—in some cases only once in two or three months—give rise to noxious effluvia. The surface of this water is sometimes covered with green animalculæ of various species, producing abundance of mosquitoes.

I feel fully justified in attributing to these sources the effect of poisoning the air, as I suffered severely in my own person all the symptoms generally referred to the effects of marsh effluvia, such as extreme lassitude, pains in the head and limbs, intolerance of light, mental depression and anxiety, dry, parched, brown tongue, &c., all of which disappeared in three days, without the aid of medicine, upon removing to Santa Cruz, a few miles from Funchal. On my return to Santa Luzia, the same symptoms reäppeared after a residence of a few days, and continued unabated till this source of annoyance was partly removed, when some amelioration of the symptoms took place. I have not the least doubt that they would have disappeared completely could the stagnant water have been entirely got rid of; but, although my landlord had lived some years in England, I had much trouble to convince him that water could be at all offensive after being kept two months in a tank. As a proof of the contrary, he asserted that the tank had been kept full for two years without changing, and that at the expiration of that period the water was perfectly sweet. I instance this as a specimen of the ignorance an invalid may have to contend with, and the impossibility of freeing himself from many causes of disease; although the removal of them might be so easily effected could the natives be made sensible of the dangers to which, by their apathy and ignorance, they expose themselves and others.

Other curious facts, illustrative of the hygienic character of Madeira, from the appearance and health of the natives, might be adduced, with various physiological and meteorological observations; but we have said enough to indicate the nature of the treatise. Its value arises less from its accuracy of proof than from its suggestions. There seems reason to believe that the year of Dr. Mason's observations was an extraordinarily wet one; so that his idea of the general moisture of the climate may be exaggerated; but the fact of moisture remains unshaken. The effects of the Leste do not appear to be so beneficial as he concludes; for after one of these winds blew, Dr. Mason had a sharp attack of illness, owing to exposure to that or to the sun. Still the indication seems sound enough, that if the Leste agree with you Madeira will not. The great value of the book, however, consists in the arguments it advances on the character of the atmosphere—hot, cold, dry, moist, and the effects of those qualities on the human frame, singly or in conjunction; on the importance of considering the influence of climate in particular constitutions, and on the propriety of instituting a variety of observations to fix the climatorial characteristics of different places. It is true, this is now and has long since been done: "That climate is too bracing (or too relaxing) for *you*," is a constant remark of medical men. But the operation of a law is known and acted upon long before the principle is discovered. Sir James Clark and other writers have considered climate in relation to dryness and moisture, though rather perhaps empirically than systematically. Heineken also had made some observations on the moisture of Madeira, several years before Dr. Mason, but tending to the same conclusion. Still, we think, the latter physican has treated the subject more fully and systematically; besides calling attention to the very important question of the influence of the atmospheres on respiration and on the excretion from the skin and the lungs.

The Russian Geographical Society has decided upon exploring that portion of the Northern Ural which lies between Mount Kwognar and the pass of Koppol; an extent of 2,000 wersts, which has not been explored by the Ural expedition. The expedition will consist of only three persons—a geognort, who also determines the altitude, a geographer, and one assistant. A great number of attendants, interpreters, work-people, and rein-deer sledges, have already been engaged. The expedition will set out immediately, and it is hoped will complete the investigation by September.—*St. Petersburg Letter.*

The theatrical machinists of Paris have invented a beautiful "snow" for stage-effects. The "flakes are seen drifting and agitated by the wind, in a manner altogether magical." The appearance, as the snow covers the ground, perfectly resembles nature.

From the Tribune.

THE TERRORS OF VESUVIUS.

A GRAPHIC account of the late eruptions of Vesuvius has scarcely yet appeared in the journals of this country. We imagine the following comparatively vivid outline, extracted from a London paper, may not be uninteresting to our readers.

The insufferable dulness and gloom which have reigned in this fair city for some weeks past, *malgré* the Carnival and the usual balls and gayeties, have at last been dispelled by the excitement caused by one of the finest eruptions of Mount Vesuvius ever known. For some twelve or fourteen days the mountain has been in labor, giving manifest indications, by groans and wailings, of bringing forth speedily something more than a mouse. On the 6th, volumes of smoke and vapor, with occasional sheets of flame, were succeeded, from time to time, by awful subterranean rumblings; and, on the morning of the 7th, the lava made its appearance, running down the mountain, on the side of Torre Annunziata, in seven or eight distinct streams. On the evening of the latter day, a party of us ascended to the Hermitage, and thence, on foot, with guides and torches, to the cone, from whence a fine view was obtained of the lava at a white heat, as it was pumped out of the crater, and thence bent its way in the direction of Pompeii and the Bosco Reale. This ascent was very fatiguing and disagreeable, and one of the party had a narrow escape from fracturing a limb by a fall. During the night of the 8th, the roaring and bellowing of the crater kept most people from enjoying their rest, and, on the whole of the 9th, volumes of smoke, lava, and vapor, together with huge stones and scoriæ, were ejected without intermission. On the evening of this day a special train was announced to leave Naples, at six o'clock, for Torre Annunziata, returning at eleven. About 400 natives and foreigners availed themselves of this opportunity; and a strong party of *Inglesi*, with guides and torches, and mules and donkeys, proceeded from the station at Torre Annunziata to the Bosco Reale, which is about five miles, through narrow lanes and country roads. There was no cause for apprehension, however, as the government had taken care to send strong bodies of troops, both horse and foot, for the protection of life and property, and the preservation of order. The sight that met our view on our arrival at the Bosco was grand in the extreme. The lava presented a frontage of at least a mile and a half, and was advancing slowly but steadily and surely, and devouring everything in its way. On the road we had met parties of poor peasants carrying beds, chairs, pots, pans, and other movable furniture, which they had been able to save from the devouring liquid; the women and children rending the air with their groans and cries and supplications to the San Gennaro, the patron saint of those parts. These poor wretches were thrown on the world homeless and penniless.

By the time of our arrival, which was about nine o'clock, the lava had taken complete possession of the wood, having devoured about half of it. At times a row of three or four hundred saplings caught fire simultaneously, producing a vivid flame and lighting up the country for miles around. Some splendid full-grown ilex, oak, and ash trees, offered in their ponderous trunks a momentary resistance; but it was to no purpose, the larger ones generally exploding with a loud report and a leap of twelve or fourteen feet in the air, to be consumed like tinder on their descent. It was curious to observe, when, from a sudden rush of lava, which always occurred after a temporary obstruction, how the larger trees gave out tens of thousands of little jets of steam from the knees and elbows of the smaller branches. It was owing to the roots and trunks coming immediately and suddenly in contact with the lava, and before the whole tree had had a preparatory roasting previously to its final combustion. In these cases the tree generally exploded; those, on the contrary, that had had their initiatory grilling, generally bowed their heads slowly and majestically, dying like Cæsar, in their dignity. As this novel and brilliant spectacle quite absorbed our attention, the majority of us lost the return train to Naples, and decided to pass the night on the spot. There was no moon, but the stars shone clearly, and the sky was cloudless; a cold *tremontana*, however, on one side, and the insupportable heat of the advancing furnace on the other, made it necessary for us to keep revolving from time to time like bottle-jacks before the lava, to obviate being frozen on one side and baked on the other. At about three o'clock in the morning the eruption was at its height. The amount of lava was quintupled, and the masses of stones which shot up into the air descended with a reverberating crash. It was the discharge of these stones which caused a noise that rendered our voices inaudible. I can only compare it to the concussion produced by the broadside of a three-decker. The ground at times trembled under our feet, and a wailing, sobbing, distressing sound seemed to indicate that nature was undergoing a horrible subterranean convulsion; and thus gave vent to the "throes and throbs" of her agony. At about four o'clock the destroyer advanced to a farm-house and outbuildings, which seemed, from their solidity, being built of rubble stone, and joined with the well-known Roman cement, likely to offer a stout resistance. And here the lava seemed to be endowed with consciousness and instinct. No sooner did it feel the momentary check than it commenced rising like the water in the lock of a canal, and from being at its arrival about twelve feet deep, speedily rose to about thirty; and attacking the bomb-shaped solid stone roof of the main building, and, at the same time, running in at the windows and doors, caused a rarification and condensation of air, that made the whole concern *sauter* with a terrific report. A very serious accident nearly occurred at the time, from the incautious curiosity of a "free-born" citizen of the States. When no traces of the farm or offices were any longer visible, being covered by a smooth surface of liquid fire, the poor agriculturist, the proprietor, together with his *sposa*, their children, and some half-a-dozen louts, set up a yell, and beat their breasts, and tore their hair in the true Neapolitan fashion. Instead of saving as much as they could from destruction, beyond their mere bedding, they did not attempt to remove a single thing. Thus all the doors and fittings, mangers, troughs, also about an acre of cabbages, carrots, and celery, together with various gates and farming utensils, were allowed to be destroyed. There was ample time to move these things, but they preferred howling and calling on San Gennaro either to do it for them or stop the torrent of lava.

A still more interesting and affecting spectacle was presented about an hour after, by the destruction of a small church, embosomed in this hapless wood. The lava here, as at the farm, had a rather

tough job, from the extreme solidity of the edifice; and, with a sort of instinct and conscious pride in its own irresistible power, it dashed forward to the attack, despite the moans and chants of a parcel of Franciscan friars connected with the church, and of the mute sorrow of the poor curé. The ornaments of the altar, together with the pictures, statues, and finery of the Virgin and the patron saints, and the parish records, had all been removed; but the incessant entreaties of the curé failed to induce his parishioners to put their shoulders to two fine doors, and lift them off their hinges to a place of security, which they could easily have done. The bells also might have been saved with little exertion. No; the Virgin or the patron saint would either appear corporeally, that is, visibly, and stop the sacrilegious destroyer, or the edifice would resist and go scathless. From time to time the bells were tolled mournfully, and curé, monks, and parishioners, chanted the funeral dirge of the sacred edifice where most of them had been baptized, and which was associated with all the prominent parts of their little secluded lives. The lava here insinuated itself into the crypt of the building, thereby undermining it, so that it was literally a "temple rent in twain," the two nearly equal portions of which rocked and tottered to their base, and then fell—belfry, bells, and all—into the burning gulf. Several passages of the "Inferno" of Dante were called to recollection this night, and the divine poet ably describes what here palpably and tangibly represented hell, though upon earth. For half an hour an intense dark green flame played over where once stood the doomed edifice, caused perhaps by the fusion of the bell-metal below. In other parts blue flames of various degrees of intensity and depth of color played and flickered about. All night parties arrived from Naples, who had missed the train; and the wood was glittering with torches approaching and receding in the distance. The arrival of a large body of priests, mounted on all the available jackasses and mules in the neighborhood for miles round, caused an immense sensation among the rustics, as there was little doubt these worthy men would soon settle the business of the ruthless enemy, and put things to rights; so to it they went, clergy and laity; and, on our departure from this scene of desolation and woe, the welkin resounded with the exertions of some hundreds of pairs of lungs. Much of the beauty of the effect faded on the approach of daylight, and when we left, which was at exactly half-past six in the morning, the lurid glare and vivid brilliancy of the lava was succeeded by a black carbonaceous dulness, with only here and there a deep red glow; the volume of lava had also diminished, and the crater was hushed. Nature seemed to have a slight intermission of her pangs, to be resumed the following evening.

On our return to Naples, we learned that a tragedy of another and a more sanguinary kind had been enacting elsewhere during the night. Hundreds visited the crater itself, and the mountain was literally dotted with little bright star-like points, ascending and flitting like will-o'-th'-wisps. The effect was picturesque in the extreme. A party of American officers of the squadron here, with characteristic and national rashness and curiosity, approached too near, and one of the officers, a fine, handsome young fellow, received a mass of hot calcareous matter on the right shoulder, which stripped the flesh to the bone as far as the elbow. There was no actual fracture, but the hemorrhage was so violent, and so long a time elapsed before he received proper medical aid, that he lies with little hope of recovery. All the Galenic skill of the place is tending him. He is only 22, remarkably amiable and handsome, and quite the pet of the squadron and of the ladies. He holds the position of commodore's naval *aide-de-camp*, and is a lieutenant in rank. Only a few nights since we had seen him at a ball, the gayest of the gay, his fine manly form and features making him almost "the observed of all observers." But another accident, within ten yards of the same spot, and almost at the same time, terminated fatally. The victim of his rashness was a Polish officer, who received a mass of stone of some tons weight on the left thigh, which caused a compound fracture, and there he lay and bled to death, his blood running down into the very crater itself, where it boiled, and hissed, and steamed. A Neapolitan gentleman, who related the particulars to us, nearly lost his life, in his exertions to bring the body down the side of the mountain, for at the time the lava and stones fell in all directions thick and fast. Another individual, a native, had the dexter side of his lower jaw completely removed by a stone, which was shot obliquely out of the crater, while he was stretching over peering into its fiery depths. The catalogue of contusions, abrasions, and lesions on that eventful night would nearly fill one of your columns. The ladies were everywhere in the van of danger and fatigue, and some have not gone off scot free. The fair sex have a great deal more courage than we men are willing to give them credit for. This is proved here daily by the intrepidity small and delicate women show in their ascents. True, it is to gratify curiosity, a strong instinct *on dit*, in their nature.

THE POSTING OF NEWSPAPERS, VIEWED FROM WITHIN.—It was a quarter before six o'clock when they crossed the Hall—six being the latest hour at which newspapers can be posted without fee. It was then just drizzling newspapers. The great window of that department being thrown open, the first black fringe of a thunder-cloud of newspapers impending over the Post-office was discharging itself fitfully—now in large drops, now in little; now in sudden plumps, now stopping altogether. By degrees it began to rain hard; by fast degrees the storm came on harder and harder, until it blew, rained, hailed, snowed, newspapers. A fountain of newspapers played in at the window. Waterspouts of newspapers broke from enormous sacks, and engulphed the men inside. A prodigious main of newspapers, at the Newspaper River Head, seemed to be turned on, threatening destruction to the miserable Post-office. The Post-office was so full already, that the window foamed at the mouth with newspapers. Newspapers flew out like froth, and were tumbled in again by the bystanders. All the boys in London seemed to have gone mad, and to be besieging the Post-office with newspapers. Now and then there was a girl; now and then a woman; now and then a weak old man: but as the minute hand of the clock crept near to six, such a torrent of boys, and such a torrent of newspapers, came tumbling in together pell-mell, head over heels, one above another, that the giddy head looked on chiefly wondering why the boys, springing over one another's heads, and flying the garter into the Post-office with the enthusiasm of the corps of acrobats at M. Franconi's, did n't post themselves

nightly, along with the newspapers, and get delivered all over the world. Suddenly it struck six. Shut Sesame! Perfectly still weather. Nobody there. No token of the late storm—not a soul too late! But what a chaos within! Men up to their knees in newspapers on great platforms; men gardening among newspapers with rakes; men digging and delving among newspapers as if a new description of rock had been blasted into those fragments; men going up and down a gigantic trap—an ascending and descending-room worked by a steam engine—still taking with them nothing but newspapers! All the history of the time, all the chronicled births, deaths, and marriages, all the crimes, all the accidents, all the vanities, all the changes, all the realities, of all the civilized earth, heaped up, parcelled out, carried about, knocked down, cut, shuffled, dealt, played, gathered up again, and passed from hand to hand, in an apparently interminable and hopeless confusion, but really in a system of admirable order, certainty, and simplicity, pursued six nights every week, all through the rolling year! Which of us, after this, shall find fault with the rather more extensive system of good and evil, when we don't quite understand it at a glance; or set the stars right in their spheres? The friends were informed that 70,000,000 newspapers passed through all the post-offices every year. Upwards of 80,000,000 newspaper stamps are distributed annually from the Stamp-office; but most of the London papers are conveyed into the country by early trains. On the other hand, frequently the same paper passes through the post several times, which accounts for the small excess of 10,000,000 stamps issued over papers posted. In weight, 187 tons of paper and print pass up and down the ingenious "lift" every week, and thence to the uttermost corners of the earth—from Blackfriars to Botany Bay, from the Strand to Chusan.—*Dickens' Household Words.*

FRANKLIN AT THE FIRESIDE.—Never have I known such a fireside companion as he was, both as a statesman and a philosopher; he never shone in a light more winning, than when he was seen in the domestic circle. It was once my good fortune to pass two or three weeks with him at the house of a gentleman in Pennsylvania, and we were confined to the house during the whole of that time by the unremitting constancy and depth of the snow. But confinement could not be felt where Dr. Franklin was an inmate. His cheerfulness and his colloquial powers spread around him a perpetual spring. Of Franklin no one ever became tired. There was no ambition of eloquence, no effort to shine in anything which made any demand either upon your allegiance or your admiration.

His manner was just as unaffected as infancy. It was nature's spell. He talked like an old patriarch, and his plainness and simplicity put you at once at your ease, and gave you the full and free possession and use of all your faculties.

His thoughts were of a character to shine by their own light, without any adventitious aid. They required only a medium of vision, like a pure and simple style, to exhibit in the highest advantage their native radiance and beauty. His cheerfulness was unremitting. It seemed to be as much the systematic and salutary exercise of the mind, as of its superior organization. His wit was of the first order. It did not show itself merely in occasional corruscations, but, without any effort or force on his part, it shed a constant stream of the purest light over the whole of his discourse.

Whether in company with commoners or nobles, he was always the same plain man, always most perfectly at his ease, his faculties in full play, and the full orbit of his genius forever clear and unclouded, and the stores of mind were inexhaustible. He had commenced his life with an attention so vigilant, that nothing had escaped his observation, and every incident turned to advantage. His youth had not been wasted in idleness, nor overcast by intemperance. He had been all his life a close and deep reader, as well as thinker, and by force of his own powers had wrought up the raw materials which he had gathered from books with such exquisite skill and felicity, that he had added a hundred fold to their original value, and justly made them his own.—*William Wirt.*

LETTERS from Sloperton give a most painful account of the decaying health of the poet Moore, whose death was daily apprehended. For three months past Mr. Moore had not left his room, and altogether his condition was considered hopeless.—*Dublin Correspondent of the Morning Chronicle.*

FALSEHOOD.—It is more from carelessness about truth, than from intentional lying, that there is so much falsehood in the world.—*Dr. Johnson.*

STORM AND CALM.

NIGHT came upon the mountains, not in bright
Though ebon mantle, star-bedight;
Nor in the softened glow of Luna's sheen
Stole languid Nature's welcome queen;
In silent gloom,
As of the tomb,
Her heavy pall closed o'er the anxious earth,
Which felt the brooding storm gathering its strength for birth.
The music of the mighty wind-harp's strings
Prefaced the rush, as of a thousand wings,
His sulphurous darts red lightning flings—
The rocky steeps rebound the thunder's roar,
In sweeping sheets the clouds their waters pour—
Deafened—half-blind,
Nor snorting, startled beast, nor man the path may find.

* * * *

The air is drugged with the rich steam from flowers
Bathed in soft dew—the evening hours
Steal on so gently that their golden haze
Is merged in softening silver rays;
Which nor reveal
Nor yet conceal,
But cast a veil of brightness o'er fair things,
And hide the gross and dark from our imaginings.
Nature is sleeping sweetly—all around
Is calm and peaceful, as if holy ground;
Of human life a distant sound,
The railroad hum, borne gently on the breeze,
Scares not the bat moth-hawking in the trees.
O heavenly night!
For all sweet influences descend in thy pure light!

Fraser's Magazine. A. M. H.

From the Edinburgh Review.

Elementary Sketches of Moral Philosophy, delivered at the Royal Institution, in the Years 1804, 1805, *and* 1806. By the late Rev. SYDNEY SMITH, M. A. London, 1849. pp. 424.

THIS volume—printed, but, at the time we are writing, not yet published—appeals not to our tribunal; one hundred copies only have been issued to gratify the eye of private friendship. Under such circumstances, we feel little disposition to make it the subject of detailed criticism; nor would our disinclination for the task be removed, even were the merit of the volume much less, or its faults much greater, than they will either of them be found to be. For the deficiencies in a posthumous work, the publication of which was neither contemplated nor desired by him, the author cannot properly be held responsible. It is its merits alone, which are indeed his own. But in the present case those merits may be more gracefully made the subject of minute criticism anywhere than in this Journal, the pages of which have been so often illuminated by his wit and genius. Of that wit and genius it is not now necessary, here or elsewhere, to enter into a critical estimate. Sydney Smith has had his due place of honor long assigned him. We shall better occupy the little space allotted to us by presenting our readers with a few brief specimens of that vigorous intellect—a few scintillations of that brilliant wit—which in past times have so often delighted them.

But, alas! there are other reasons for inexpressible reluctance to assume the critic's office in the case before us. The duty has been virtually performed by one—and it was the last office of the kind he ever did perform—than whom none could perform it more justly or more kindly—by one of whom we do not venture to say more at present. We refer to that illustrious friend of Sydney Smith who, in conjunction with him and other men of genius, projected the present Journal, and who presided for so long a series of years over the tribunal of criticism he had established, with a taste, skill, and energy, on which the public has already long since pronounced its judgment. He has now passed from among us; but his name and memory are embalmed in the veneration and affection of all who knew him.

Lord Jeffrey had received the present volume, and was engaged in perusing it, only a few days before his death. The delight it gave him, and the spirit in which he seized the opportunity it afforded him of expressing his sense of the merits he had overlooked at first, are so strikingly characteristic of his candor and generosity of nature, that we must not suppress a brief account of what passed on the occasion.

The notes of these lectures, delivered nearly half a century ago—about the period, in fact, when the two friends first commenced their long literary career—were never prepared or designed for publication. Their author had even often resolved on their destruction; and, on one occasion, partly accomplished his purpose. His family naturally begged a reprieve, and wisely as well as naturally; for, as old Fuller says of Herbert's remains, even "shavings of gold are carefully to be kept." At his death, the interest of the family in them was renewed. Anxious to ascertain the propriety or otherwise of giving these lectures to the public, and knowing how well they could rely on Lord Jeffrey's judgment and kindness, Mrs. Smith sent the manuscript to him for his opinion. He—doubtless feeling, much more strongly than the generality of men, how much injustice is often done to genius by publishing what itself would be mortified to think should see the light without the advantage of careful revision, and perceiving, also, on a slight and partial inspection, that some parts of the present work would require that revision to do them full justice—advised that the volume should not be published. Out of acquiescence, we may presume, in this sentence, a few copies only were struck off in the first instance for private circulation.

And now comes the incident which it is such a pleasure to record. On perusing the volume in print, Lord Jeffrey at once discerned, in spite of *hiatus*, mutilations, and imperfections, so many indications of the "vis vivida" of genius—so many traces of originality, splendor, and power—that he lost no time in writing to Mrs. Smith a beautiful letter, retracting his former cautious judgment in the amplest manner. "I cannot rest," said he, "till I have not merely expressed my thanks to you for the gratification I have received, but made some amends for the rash, and I fear somewhat ungracious, judgment I passed upon it, after perusing a few passages of the manuscript some years age. I have not recognized any of these passages in any part of the print I am reading, and think I must have been unfortunate in the selection, or chance, by which I was directed to them. * * * I am now satisfied I was quite wrong. My firm impression is, that, with few exceptions, they will do him as much credit as anything he ever wrote; and produce, on the whole, a stronger impression of the force and vivacity of his intellect, as well as a *truer* and more engaging view of his character, than what the world has yet seen in his writings. Some of the conclusions may be questionable, but I do think them generally just, and never propounded with anything like arrogance, or in any tone of assumption; and the whole subject treated with quite as much, either of subtlety or profundity, as was compatible with a popular exposition of it. I *retract*, therefore, peremptorily and firmly, the advice I formerly gave against the publication of these discourses."

It was traits like these—of sweetness, frankness, and fearless love of truth; the rare magnanimity which made him ever ready to recant an error, when he had reason to suspect that he had been betrayed into one—traits beautifully displayed in his introduction to his essays reprinted from this Journal—which not only endeared him to so large a circle of friends, but rendered it impossible for him to have any permanent enemies. Such qualities

had, in fact, long before his death, conciliated towards him the esteem and affection of most of those who, in earlier years, thought they had reason to complain of the severity of the criticisms which he had either himself passed, or had suffered others to pass, on their productions. Even literary animosities—the most embittered, perhaps, of any—could not but yield before the genial warmth of his frank and kind-hearted nature. These traits made him more truly great than the opulence of his knowledge—the elegance of his fancy—the acuteness of his logic—or the vigor and the versatility of his genius.

After such a testimony, we trust that the publication of these "Elementary Sketches" may be confidently reckoned upon—perhaps before the appearance of our present number; in which case it is to be hoped that this beautiful and instructive letter will be prefixed to them.

Paradoxical as the statement may seem, we think there was sufficient reason for Lord Jeffrey to affirm both his early and his later judgment; reason, in the first instance, for his caution—prompted doubtless by a genuine solicitude for his friend's reputation—and reason for his subsequent retractation on seeing the whole in print. He perceived that the volume, after all deductions, was everywhere so pervaded with vigorous thought, and so adorned by felicitous illustration, as to render it not only not unworthy of Sydney Smith's genius, but an acceptable contribution to the literature of mental philosophy: not to mention the numerous passages which, as often as the lecturer has occasion to apply his philosophy to the business and bosoms of men, do the greatest honor to the elevation of his sentiments and the humanity of his heart.

In truth, we are disposed to concur with Lord Jeffrey, in thinking, that however some *hiatus* may be "lamented," and certain modifications desiderated, this volume will raise Sydney Smith higher in the esteem of the public, as a thinker, than any of his previous writings. He has been by many principally regarded as a man of exquisite wit indeed, but of little more than wit; of infinite facetiousness, but with moderate powers of argument or speculation, at least in relation to abstract science. We are much mistaken if these pages do not vindicate his claim to rank with philosophers; whether he be not an illustration of his own theory, propounded in one of these lectures, and more than once propounded by other writers in this journal—that great wit rarely exists alone; that few men have ever possessed it in extraordinary measure, without being *capable* by nature of achieving something higher and better than its own triumphs; a theory supported by the fact that in one or other of its diversified modes, it has been an almost inseparable concomitant of the most splendid forms of genius—whether in the departments of philosophy, poetry, or eloquence.

There are few parts of these lectures over which it is possible to glance, especially when we bear in mind the abstruseness of the subject, and the youthfulness of the professor—difficulties not likely to be lightened by the necessity of descanting on such themes before a popular and miscellaneous audience — without being struck with the indications of power which they everywhere present. Inexhaustible vivacity and variety of illustration one would, of course, expect from such a mind; but this is far from being all. The sound judgment and discrimination with which he often treats very difficult topics—the equilibrium of mind which he maintains when discussing those on which his own idiosyncrasy might be supposed to have led him astray—of which an instance is seen in his temperate estimate of the value of wit and humor—the union of independence and modesty with which he canvasses the opinions of those from whom he differs—the comprehensiveness of many of his speculations, and the ingenuity of others—the masterly ease and perspicuity with which even abstruse thoughts are expressed, and the frequently original, and sometimes profound, remarks on human nature to which he gives utterance—remarks hardly to be expected from *any* young metaphysician, and least of all from one of so lively and mercurial a temperament—all render these lectures very profitable as well as very pleasant reading; and show conclusively that the author might, if he had pleased, have acquired no mean reputation as an expositor of the very arduous branch of science to which they relate. Doubtless there is many a "bone" in these lectures which a keen metaphysician would be disposed to "pick" with the author; for when was a metaphysical banquet spread without abundance of such meagre fare? Still the general merits of the volume every man of sense will assuredly admit to be very great.

But our readers will feel that our rapidly dwindling space had better be devoted to giving them some light prelibation of the contents of this interesting volume, than to further disquisition on either its merits or defects: and to this accordingly we proceed.

When Sydney Smith undertook to popularize to a London audience the subject of Mental Philosophy, he was just fresh from the schools of Edinburgh, where he had heard Dugald Stewart and Thomas Brown prelecting on their favorite science. It is impossible to conceive an assembly less adapted to the reception of such mysteries than a metropolitan audience of that period. It would have been almost as hopeful for a Stoic to lecture on Zeno's system in the Garden of Epicurus.

The title of the lectures will be apt to mislead many readers of the present day. The author uses the words "Moral Philosophy" in the sense in which they were currently accepted in the schools in which he had been studying; as including, that is, not only, what they are so often now used to import, Ethics properly so called, but the whole of what is denominated at present "Mental Philosophy."

The Introductory Lecture is certainly not the least interesting in the volume. The following remarks on the alleged uncertainty and vagueness of the science are very characteristic :—

The existence of mind is as much a matter of *fact* as the existence of matter; it is as true that men remember, as that oxygen united to carbon makes carbonic acid. I am as sure that anger and affection are principles of the human mind, as I am that grubs make cock-chafers; or of any of those great truths which botanists teach of lettuces and cauliflowers. The same patient observation, and the same caution in inferring, are as necessary for the establishment of truth in this science as in any other; rash hypothesis misleads as much, modest diligence repays as well. Whatever has been done for this philosophy has been done by the inductive method only: and to that alone it must look for all the improvement of which it is capable. * * *

A great deal of unpopularity has been incurred by this science from the extravagancies or absurdities of those who have been engaged in it. When the mass of mankind hear that all thought is explained by vibrations and vibratiuncles of the brain —that there is no such thing as a material world— that what mankind consider as their arms and legs are not arms and legs, but *ideas*, accompanied with the notion of *outness;* that we have not only no bodies, but no minds—that we are nothing, in short, but currents of reflection and sensation ;—all this, I admit, is well calculated to approximate in the public mind the ideas of lunacy and intellectual philosophy. But if it be fair to argue against a science from the bad method in which it is prosecuted, such a mode of reasoning ought to have influenced mankind centuries ago to have abandoned all the branches of physics as utterly hopeless. I have surely an equal right to rake up the mouldy errors of all the other sciences—to reproach astronomy with its vortices—chemistry with its philosopher's stone—history with its fables—law with its cruelty and ignorance—and if I were to open this battery against medicine, I do not know where I should stop. Zinzis Khan, when he was most crimsoned with blood, never slaughtered the human race as they have been slaughtered by rash and erroneous theories of medicine.

If there be a real foundation for this science, if observation can do *anything*, and has not done all, there is room for *hope*, and reason for exertion. The extravagancies by which it has been disgraced, ought to warn us of the difficulty, without leading us to despair. To say there is no path, because we have often got into the wrong path, puts an end to all other knowledge as well as to this.

The truth is, it fares worse with this science than with many others, because its errors and extravagancies are comprehended by so many. * * * Every man is not necessarily an astronomer, but every man has some acquaintance with the operations of his own mind; and you cannot deviate *grossly* from the truth on these subjects without incurring his ridicule and reprehension. This perhaps is one cause why errors of this nature have been somewhat unduly magnified.

Nor less characteristic are the observations in confutation of the asserted tendency of the science to foster scepticism :—

Scepticism, which is commonly laid to the charge of this philosophy, may, in the first place, be fairly said to have done its worst. Bishop Berkeley destroyed this world in one volume octavo; and nothing remained after his time, but mind—which experienced a similar fate from the hand of Mr. Hume, in 1737; so that, with all the tendency to destroy, there remains nothing left for destruction; but I would fain ask if there be any one human being, from the days of Protagoras the Abderite to this present hour, who was ever for a single instant a convert to these subtle and ingenious follies? Is there any one out of Bedlam who *doubts* of the existence of matter? who doubts of his own personal identity? or of his consciousness, or of the general credibility of memory? Men *talk* on such subjects from ostentation, or because such wire-drawn speculations are an agreeable exercise to them; but they are perpetually recalled by the necessary business, and the inevitable feelings of life, to sound and sober opinions on these subjects. Errors, to be dangerous, must have a great deal of truth mingled with them; it is only from this alliance that they can ever obtain an extensive circulation; from pure extravagance, and genuine, unmingled falsehood, the world never has, and never can, sustain any mischief. It is not in our power to believe all that we please; our belief is modified and restrained by the nature of our faculties, and by the constitution of the objects by which we are surrounded. We may believe anything for a moment, but we shall soon be lashed out of our impertinence by hard and stubborn realities. A great philosopher may sit in his study, and deny the existence of matter; but if he goes to take a walk in the streets he must take care to leave his theory behind him. Pyrrho said there was no such thing as pain; and he saw no *proof* that there were such things as carts and wagons; and he refused to get out of their way; but Pyrrho had, fortunately for him, three or four stout slaves, who followed their master, without following his doctrine, and whenever they saw one of these ideal machines approaching, took him by the arms and legs, and, without attempting to controvert his arguments, put him down in a place of safety. (P. 7.)

The following observations are in a higher mood :—

But what are we to do? If the enemies of religion derive subtlety and acuteness from this pursuit, ought not their own weapons to be turned against them? And ought not some to study for defence if others do for the purposes of aggression? When the old anarch Hobbes came out to destroy the foundations of morals, who entered the lists against him? Not a man afraid of metaphysics, not a man who had become sceptical as he had become learned, but Ralph Cudworth, Doctor of Divinity; a man who had learned much from reading the errors of the human mind, and from deep meditation, its nature ;—who made use of those errors to avoid them, and derived from that meditation principles too broad and too deep to be shaken; such a man was gained to the cause of morality and religion by these sciences. These sciences certainly made no infidel of Bishop Warburton, as Chubb, Morgan, Tindal, and half a dozen others found to their cost. * * * Locke was no sceptic, nor was Lord Verulam. Malebranche and Arnauld were both of them exceedingly pious men. We none of us can believe that Doctor Paley has exercised his mind upon intellectual philosophy in vain. The fruits of it in him are sound sense, delivered so perspicuously, that a man may profit by it, and a child may comprehend it.

I have already quoted too many names, but I must not omit one which would alone have been sufficient to have shown that there is no necessary connection between scepticism and the philosophy of the human mind: I mean Bishop Butler. To his sermons we are indebted for the complete overthrow of the selfish system, and to his "Analogy" for the most noble and surprising defence of revealed religion, perhaps, which has ever yet been made of any system whatever.

In a yet finer style are the remarks on the proofs which the mind itself affords of a Divine Creator —a subject not yet fully worked out, by either Dr. Chalmers or by any of the several writers whom Dr. Turton has enumerated in his "Natural Theology;" and which requires, to do it full justice, the deliberate labors of a mind—if ever there shall be such a prodigy—uniting the metaphysical depth of Butler with Paley's felicity of *representation*:—

But there is no occasion to prop this argument up by great names. The school of natural religion is the contemplation of nature; the ancient anatomist, who was an Atheist, was converted by the study of the human body; he thought it impossible that so many admirable contrivances should exist, without an Intelligent Cause: and if men can become religious from looking at an entrail, or a nerve, can they be taught Atheism from analyzing the structure of the human mind? Are not the affections and passions, which shake the very entrails of man, and the thoughts and feelings which dart along those nerves, more indicative of a God than the vile perishing instruments themselves? Can you remember the nourishment which springs up in the breast of a mother, and forget *the feelings which spring up in her heart?* If God made the blood of man, did he not make that *feeling*, which summons the blood to his face, and makes it the sign of guilt and of shame? You may show me a human hand, expatiate upon the singular contrivance of its sinews and bones—how admirable, how useful for all the purposes of grasp and flexure! *I* will show you, in return, the mind, receiving her tribute from the senses;—*comparing*, *reflecting*, *compounding*, *dividing*, *abstracting*;—the passions *soothing*, *aspiring*, *exciting*, till the whole world falls under the dominion of *man*; evincing that in his mind the Creator has reared up the noblest emblem of his wisdom and his power. The philosophy of the human mind is *no* school for infidelity, but it excites the warmest feelings of piety, and defends them with the soundest reason. (P. 11.)

The observations on the *utility* of the science are distinguished by a most judicious moderation —moderation the more admirable when it is considered that it is almost an uniform tendency of the juvenile metaphysician to form exaggerated estimates of the *practical* value of his favorite pursuits; and that the distinguished man, at whose feet Sydney Smith had so reverently sat as pupil, had prophesied all sorts of splendid results from the more vigorous prosecution of the inductive science of mind—in relation particularly to education, legislation, and political economy. Such prospects, it need hardly be said, have not been realized; nor in our view are they likely to be. This branch of science, indeed, will be always worthy of the profound study of an intelligent nature; for what, in truth, can be worthy of it, if the very structure and mechanism of that very nature itself be not! These subjects are worthy of investigation quite apart from any presumed utility; just as there are many other things which we all study, and many study deeply, from the *direct* use of which not one in a million anticipates the actual making of two-pence. As to the immediately practical bearings of Mental Philosophy on education, we apprehend, with Sydney Smith, that all its more important facts have been pretty patent to mankind for thousands of years. And it may be added, that the application even of these more obvious facts depends much more on practical tact, skill, and habit, than on any profound knowledge of their theory. The best schoolmasters, we suspect, have not been, nor are likely to be, the most refined mental analysts.

The *real* utility of the science consists in its being a peculiar *discipline*, a valuable system of intellectual gymnastics; in its immediate influence on our *habits* of thinking, investigation, and expression; and in the light it throws on the criticism of the greatest of the Fine Arts, more particularly on poetry and eloquence—the philosophy of which is, in fact, a section of the science of mind. In these points of view, and especially in the two first, the utility of the science cannot be easily exaggerated; like language and the mathematics, it forms an essential part of that just and comprehensive training which must be employed in order to develop, in harmonious proportion, *all* the faculties of the human mind. These branches of education are all supplementary to one another; not one can be wisely dispensed with. Their capacity of *direct* application is in most cases secondary to their value as a discipline. But though not one person in a hundred may ever need to make use, in ordinary life, of the formulæ of Trigonometry, or the Calculus, or to refer to Descarte's Theory of "Innate Ideas," or Berkeley's "Theory of Vision," it is sufficient if the studies such things involve have ministered, better than any other branches of mere discipline could, to form a well-proportioned, active, healthy, robust mind, masters of its faculties, and capable of using them powerfully and effectively in any direction in which the exigencies of life may require them to be employed.

Of the *uses* of this science of Moral Philosophy, one is the vigor and acuteness which it is apt to communicate to the faculties. (P. 14.) * * * The subtleties about mind and matter, cause and effect, perception and sensation, may be forgotten: but the power of nice discrimination, of arresting and examining the most subtle and evanescent ideas, and of striking rapidly and boldly into the faintest track of analogy, to see where it leads, and what it will produce; an emancipation from the *tyranny of words*, an undaunted intrepidity to push opinions up to their first causes;—all these virtues remain in the dexterous politician, the acute advocate, and the unerring judge. * * * It may be of incalculable advantage to me, at an early period of life,

to guard my understanding from the pernicious effects of association, though those effects cannot now be pointed out for the first time. I might have learned something about association, *without* the aid of this science, by the mere intercourse of life, but I should not have learned that lesson so early and so well. I am no longer left to gather this important law of my nature from accidental and disconnected remark, but it is brought fully and luminously before me;—I see that one man differs from another in the rank and nobleness of his understanding, in proportion as he counteracts this intellectual attraction of cohesion; I become permanently and vigilantly suspicious of this principle in my own mind, and when called upon in the great occasions of life to think and to act, I separate my judgment from the mere accidents of life, and decide, not according to the casualties of my fortune, but the unbiassed dictates of my reason; without this science I might have had a general and faint suspicion; with it I have a rooted and operative conviction of the errors to which my understanding is exposed.

We shall not detain the reader any longer on that portion of the volume which embodies the first course of lectures, to which (if to any) the modest language of the preface is, as it seems to us, most applicable. Since they are, for the most part, a restatement of the doctrines which the metaphysicians of the Scotch school had taught respecting the "Faculties" of the mind; though illustrated with all the novelty and freshness which the author threw over everything he touched. These early lectures are also frequently imperfect, and in some places provokingly abound in those unhappy printers' "stars," which shed darkness instead of light.

The lectures on "Wit and Humor," a right facetious subject, treated, one may be assured, *con amore*, as well as those on the "Beautiful and Sublime," and on the "Faculties of Animals," are unmutilated, and are distinguished, we think, by many original observations, as striking from their matter as their manner. It is from these we shall make our necessarily parsimonious selections.

The lectures on "Wit" open with a very admirable and acute survey of the principal attempts to define that Protean thing. The author points out as he proceeds the defects of each; he shows that Barrow's celebrated description is but an enumeration of its forms, instead of a definition of its essence; that Cowley, in a similar manner, has exemplified instead of defined it; that Addison's papers on the subject in the "Spectator" rather tell us how to "form a just taste in wit than to explain what it is."

Dryden says of Wit, that it is a propriety of thoughts and words, or thoughts and words elegantly adapted to the subject; but there is a propriety of thoughts and words in one of Blair's sermons, which I never yet heard praised for their wit. And the thoughts and words are elegantly adapted to the subject in Campbell's "Pleasures of Hope," which is something much *better* than a witty poem. Pope says of wit—

> True wit is Nature to advantage drest,
> Oft thought before, but ne'er so well exprest.

Then the *Philippics of Cicero*, the *Orations of Demosthenes*, are witty; Cæsar's Commentaries are witty; Massillon is one of the greatest wits that ever lived; the Oraisons Funèbres of Bossuet are prodigies of facetiousness. Sir Richard Blackmore's notion of wit is, that it is a series of high and exalted ferments. It very possibly *may* be; but, not exactly comprehending what is meant by a "series of high and exalted ferments," I do not think myself bound to waste much time in criticizing the metaphysics of this learned physician. (P. 117.)

"Wit," says Johnson, "may be more rigorously and philosophically considered as a kind of *concordia discors*—a combination of dissimilar images, or discovery of occult resemblances in things apparently unlike;" but, if this be true, then the discovery of the resemblance between diamond and charcoal, between acidification and combustion, are pure pieces of wit, and full of the most ingenious and exalted pleasantry. (P. 120.)

Hobbes defines Laughter to be a sudden glory arising from a sudden conception of some eminency in ourselves by comparison with infirmity of others, or our own former infirmity. * * * Taking the language of Hobbes to mean the sudden discovery of any inferiority, it will be very easy to show that such is *not* the explanation of that laughter excited by humor; for I may discover suddenly that a person has lost half-a-crown—or that his tooth aches—or that his house is not so well built, or his coat not so well made, as mine; and yet none of these discoveries give me the slightest sensation of the humorous. If it be suggested that these proofs of inferiority are very slight, the theory of Hobbes is still more weakened by recurring to greater instances of inferiority; for the sudden information that any one of my acquaintance has broken his leg, or is completely ruined in his fortunes, has, decidedly, very little of humor in it;—at least, it is not very customary to be thrown into paroxysms of laughter by such sort of intelligence. (P. 136.)

In the same manner, Locke's theory of wit is shown to include much more than is now or long has been ordinarily attached to the term. We doubt, however, whether our author (or Dugald Stewart, when commenting on the same passage of Locke) sufficiently adverted to the fact that the word "wit" was used in Locke's day in a much less restricted sense than at present—a sense, of which the expression "mother wit" is a remnant—when, in fact, a man of wit was nearly synonymous with a man of genius.

The theory which finds most favor in our author's eyes is that laid down by Campbell in his "Philosophy of Rhetoric." He describes it as the best to be found in our language, and, perhaps, on the whole, with justice. But this, too, it faulty; at least it certainly includes far more than the word is now employed to designate.

The lecturer then proceeds to give us *his own* theory, which, as so often happens, is less satisfactory than his refutation of the theories of others. He defines "wit" to be the result of "any discovery of relations amongst our ideas," attended

by *surprise*, and that *only*. Surprise, he contends, and justly, often attends a perceived relation among ideas, provocative of far different emotions from that elicited by wit; as, for example, those of the beautiful or sublime; and that it is even true that there are many instances in which such "surprising discovery of relations" has not the effect of wit, simply because all thought of wit is quenched in the beautiful or sublime. But he thinks that where *surprise* only—unadulterated surprise—is the result, that then in every case we have *wit;* and that, if this be so, this constitutes its essence. He acknowledges that his definition had not given universal satisfaction, and that, to use his own expression, the week which followed the announcement of his definition was "one of the most polemical that ever he remembered to have spent in his life." He defends himself against his objectors, who adduced many examples of *facts* which occasion pure surprise, without producing any sense of facetiousness—facts which all of us experience to be unpleasantly plentiful—by saying that he did not mean that any surprising *facts* will produce the effect of wit, but any surprising "relations amongst *ideas*." We cannot say that the theory, even thus limited, will satisfy us. It seems undeniable that there are many "surprising relations" discovered amongst "ideas;" as, for example, those by which the algebraist often most unexpectedly solves a difficulty, or those which characterize some half score of the ingenious interpretations of the mysterious number in the Apocalypse, which produce no sense of the "witty" any more than of the "beautiful." They affect the mind in precisely the same manner as the discovery of the relations between the parts of some ingenious mechanical contrivance. Some of Sydney Smith's "polemical" friends might probably plead even his own definition of wit against itself, and affirm, that though it was certainly a *surprise* to them to find "any surprising relation between ideas," denominated the essence of wit, they felt none of the appropriate emotion of wit in that surprise.

It appears to us, we frankly confess, that, though a *pleased surprise* is a very general, perhaps uniform, accompaniment and condition of the emotions both of "beauty" and "wit," it is in itself as little the *essence* of one as of the other. Though it should be supposed uniformly coincident with both, it is obviously more extensive than either. If this be so, it will still require some limiting terms to define those cases, neither more nor less, in which the surprise, as felt, is coincident with wit. That is, the essence of wit is still to be sought.

Such a definition we certainly shall not attempt; and instead of pursuing this difficult subject, shall prefer, as our readers will also prefer, enjoying some of the passages of these lectures in which Sydney Smith has at all events exceedingly well *illustrated* the nature of wit, however he may have failed to exhibit its theory.

The remarks on the necessity that we should learn betimes how to defy ridicule, in adherence to our convictions of right, are admirable, and admirably expressed; nor less so those on the limits which wit must prescribe to itself if it would not render itself odious:—

I have insisted, in the beginning of my lecture, on the great power of the ridiculous over the opinions of mankind; including in that term, wit, humor, and every other feeling which has laughter for its distinguishing characteristic.

I know no principle which it is of more importance to fix in the minds of young people, than that of the most determined resistance to the encroachments of ridicule. Give up to the world, and to the ridicule with which the world enforces its dominion, every trifling question of manner and appearance: it is to toss courage and firmness to the winds to combat with the mass upon such subjects as these. But learn, from the earliest days, to enure your principles against the perils of ridicule: you can no more exercise your reason if you live in the constant dread of laughter, than you can enjoy your life if you are in the constant terror of death. If you think it right to differ from the times, and to make a stand for any valuable point of morals, do it, however rustic, however antiquated, however pedantic it may appear;—do it, not for insolence, but *seriously* and *grandly*—as a man who wore a soul of his own in his bosom, and did not wait till it was breathed into him by the breath of fashion. Let men call you mean, if you know you are just; hypocritical, if you are honestly religious; pusillanimous, if you feel that you are firm; resistance soon converts unprincipled wit into sincere respect; and no after time can tear from you those feelings which every man carries within him who has made a noble and successful exertion in a virtuous cause. * * * * (P. 134.)

* * * * It is beautiful to observe the boundaries which nature has affixed to the ridiculous, and to notice how soon it is swallowed up by the more illustrious feelings of our minds. Where is the heart so hard that could bear to see the awkward resources and contrivances of the poor turned into ridicule? Who could laugh at the fractured, ruined body of a soldier? Who is so wicked as to amuse himself with the infirmities of extreme old age? or to find subject for humor in the weakness of a perishing, dissolving body? Who is there that does not feel himself disposed to overlook the little peculiarities of the truly great and wise, and to throw a veil over that ridicule which they have redeemed by the magnitude of their talents, and the splendor of their virtues? Who ever thinks of turning into ridicule our great and ardent hope of a world to come? Whenever the man of humor meddles with these things, he is astonished to find that, in all the great feelings of their nature, the mass of mankind always think and act aright; that they are ready enough to laugh—but that they are quite as ready to drive away, with indignation and contempt, the light fool who comes with the feather of wit to crumble the bulwarks of truth, and to beat down the temples of God! (P. 139.)

The judicious and moderate estimate he forms of the value of this intellectual endowment has already been referred to as a signal proof of the equilibrium of our author's judgment, naturally disposed, as he must have been, to regard with favor a quality which he himself so highly possessed. It is thus he speaks of it:—

I wish, after all I have said about wit and humor, I could satisfy myself of their good effects upon the character and disposition; but I am convinced the probable tendency of both is to corrupt the understanding and the heart. I am not speaking of wit where it is kept down by more serious qualities of mind, and thrown into the background of the picture; but where it stands out boldly and emphatically, and is evidently the master quality in any particular mind. Professed wits, though they are generally courted for the amusement they afford, are seldom respected for the qualities they possess. The habit of seeing things in a witty point of view increases, and makes incursions, from its own proper regions, upon principles and opinions which are ever held sacred by the wise and good. * * * (P. 150.)

* * * So far the world, in judging of wit where it has swallowed up all other qualities, judge aright; but I doubt if they are sufficiently indulgent to this faculty where it exists in a lesser degree, and as one out of many other ingredients of the understanding. There is an association in men's minds between dulness and wisdom, amusement and folly, which has a very powerful influence in decision upon character, and is not overcome without considerable difficulty. The reason is, that the *outward* signs of a dull man and a wise man are the same, and so are the outward signs of a frivolous man and a witty man; and we are not to expect that the majority will be disposed to look to much *more* than the outward sign. I believe the fact to be, that wit is very seldom the *only* eminent quality which resides in the mind of any man; it is commonly accompanied by many other talents of every description, and ought to be considered as a strong evidence of a fertile and superior understanding. * * * I have talked of the *danger* of wit: I do not mean by that to enter into common-place declamation against faculties because they *are* dangerous. Wit is dangerous, eloquence is dangerous, a talent for observation is dangerous, *every* thing is dangerous that has efficacy and vigor for its characteristics; nothing is safe but mediocrity. * * * But when wit is combined with sense and information—when it is softened by benevolence, and restrained by strong principle—when it is in the hands of a man who can use it and despise it; who can be witty, and something much *better* than witty; who loves honor, justice, decency, good nature, morality, and religion, ten thousand times better than wit—wit is *then* a beautiful and delightful part of our nature. (P. 151.)

Our author dismisses "puns," "charades," and the other diminutive forms of wit, with the following summary expression of his contempt:—

I have very little to say about puns; they are in very bad repute, and so they *ought* to be. The wit of language is so miserably inferior to the wit of ideas, that it is very deservedly driven out of good company. Sometimes, indeed, a pun makes its appearance which seems, for a moment, to redeem its species; but we must not be deceived by them; it is a radically bad race of wit. By unremitting persecution it has been at last got under, and driven into cloisters, from whence it must never again be suffered to emerge into the light of the world. One invaluable blessing produced by the banishment of punning, is an immediate reduction of the number of wits. It is a wit of so low an order, and in which some sort of progress is so easily made, that the number of those endowed with the gift of wit would be nearly equal to those endowed with the gift of speech. The condition of putting together ideas, in order to be witty, operates much in the same salutary manner as the condition of finding rhymes in poetry;—it reduces the number of performers to those who have vigor enough to overcome incipient difficulties, and makes a sort of provision that that which need not be done at all should be done well whenever it *is* done. For we may observe, that mankind are always more fastidious about that which is pleasing than they are about that which is useful. A common-place piece of morality is much more easily pardoned than a common-place piece of poetry or of wit; because it is absolutely necessary for the well-being of society that the rules of morality should be frequently repeated and enforced; and though, in any individual instance, the thing may be badly done, the sacred necessity of the practice itself atones, in some degree, for the individual failure; but, as there is no absolute necessity that men should be either wits or poets, we are less inclined to tolerate their mediocrity in superfluities. If a man has ordinary chairs and tables, no one notices it; but if he sticks vulgar, gaudy pictures on his walls, which he need not have at all, every one laughs at him for his folly. * * * (P. 131.)

I shall say nothing of charades, and such sort of unpardonable trumpery. If charades are made at all, they should be made without benefit of clergy;—the offender should instantly be hurried off to execution, and be cut off in the middle of his dulness, without being allowed to explain to the executioner why his first is like his second, or what is the resemblance between his fourth and his ninth. (P. 143.)

The following observations on the degree in which wit is susceptible of *culture* are curious and just:—

It is imagined that wit is a sort of inexplicable visitation; that it comes and goes with the rapidity of lightning; and that it is quite as unattainable as beauty or just proportion. I am so much of a contrary way of thinking, that I am convinced a man might sit down as systematically and as successfully to the study of wit, as he might to the study of mathematics; and I would answer for it that, by giving up only six hours a day to being witty, he should come on prodigiously before midsummer, so that his friends should hardly know him again. For what is there to hinder the mind from gradually acquiring a habit of attending to the lighter relations of ideas in which wit consists? Punning grows upon everybody; and punning is the wit of words. I do not mean to say that it is so easy to acquire a habit of discovering new relations in *ideas* as in *words;* but the difficulty is not so much greater as to render it insuperable to habit. (P. 129.)

Our author's prelections on beauty are eminently "beautiful," but we cannot say that he appears quite consistent in his theory respecting it. We need not remind our readers what a "questio vexata" this has ever been in metaphysical criticism. Like her in whom beauty was so preëminently embodied, beauty itself has been the source of "dire contentions" between our critical

Greeks and Trojans. From the day when Plato treated it in the "Hippias Major" down to very recent times, men were as much and ludicrously in doubt about the nature and cause of what all were so familiar with, as about the theory of any facts whatever.

In general, our author accedes to the theory adopted with different modifications by most modern metaphysicians;—that the beautiful is to be sought, not in some quality or qualities of external nature itself, but in the *mind*—in pleasurable associations; that these may be of infinitely various kinds, and exist in all sorts of proportions; and that the emotion of the beautiful will depend for its intensity on the number, duration, individual force, and concurrent influence of these harmonizing elements.

This doctrine, we say, (in the main that of Alison,) our author accepts; yet, it must be confessed, he does not very consistently adhere to it. For though he has defined beauty to be "a feeling of the mind," (p. 173,) he on the next page (p. 174) speaks of beauty as "a quality of matter," and even deviates into the absolute heresy, that there are many objects which have beauty in themselves, and immediately affect the mind with it.

If by this last expression he only meant (and we half suspect that he did only mean, or *would* only have meant had he paused to adjust fully his own conceptions) that there are, as Lord Jeffrey says in his admirable critique on Alison,* many cases in which the emotion of the beautiful springs up at once in the presence of certain objects, and does not wait to be slowly deposited as the product of those long trains of associations to which Alison attributes it, few would have objected to the expression; rather, most would have accepted it as a valuable correction.

Further, if he had merely meant that the sensational and organic delight with which so many external objects, and their combinations, impress us, forms an immediate and appreciable element in the associations which determine the emotion of beauty—however inferior in power may be the associations which are so founded on them, to other and higher associations dependent on intellectual and moral causes—few, when their attention was fairly called to the fact, would have been disposed to disagree with him. It is a point, however, which has been too much overlooked. Perhaps, even Lord Jeffrey's critique has hardly given sufficient prominence to it. Had it been duly borne in mind, it would have removed that apparent paradox which seems to postpone the emotion of beauty (not merely higher degrees of it, but the emotion itself) to a long, tardy, and intricate compilation of associations. There seems something more peculiar still in the special case of an ear for music. But surely it is not difficult to suppose that the delightful sensations with which the eye and the ear, and all the senses, are regaled amidst woodland scenery on a fine spring day—the mellow tints—the golden broken light—the variety of light and shade—the pleasing effects of the play of both under the waving foliage in the green forest glade—the whispering of the winds in the trees—the warbling of birds in the branches—the bright colors and fragrant scent of flowers—constitute a very positive item in the sum of associations on which the emotion of beauty is founded, and instantaneously lead to that emotion, however capable it may be (as we see it is) of being indefinitely intensified in relation to particular localities, by repetition of the pleasure, by all the bonds of remembrance with such scenes, by all the social pleasures with which such scenes may be enriched—by all, in a word, which a cultivated and happy mind can bring to bear upon it.

But, alas! for the consistency of metaphysicians. Our lecturer certainly *says* something much more questionable, even if he would not on maturer thoughts have adhered to it. He expressly says that the eye has *beauty* for its object (at least in many cases) just as the organ of smell has fragrance for *its* object;—not merely that the eye and the ear have their appropriated *sensations* of delight from colors and sounds, as the nose from scents and the palate from flavor; but that the emotion of beauty (undoubtedly in many cases the instantaneous *reflex* of delighted sensation, though purely mental in itself) is the direct object of the eye. He says, "It seems strange to me, that men should doubt any more of the gluttony of the *eye*, than of the gluttony of the mouth. As the palate feasts upon the savory and sweet, the ear feasts upon melody, and the eye gorges upon light and color, till it aches with pleasure." He contends, in opposition to Alison and Jeffrey, that matter is capable of immediately exciting *emotion*; and seems to think that he has proved this in proving, what none deny, that it is capable of exciting agreeable or disagreeable sensations. This is of course true, and hence the approximate uniformity of men's notions of beauty; because external nature, affecting them in the same manner, will necessarily lead, for the most part, to the same associations, and therefore to a similar conception of the beautiful. But the difference of the degree of this emotion, in relation to the same objects, in different men—the absence of it in many, in relation to certain objects which inspire others with rapture—the power of investing with beauty objects once indifferent or even disagreeable—the fluctuation of the standard of taste in different ages and nations—even, in some cases, the transfer of the emotion to opposite objects in the history of the same individual, all show that association, and not sensation, is the key to its explanation. This theory, and this alone, accounts both

* Art. *Beauty, Encyc. Brit.* This exquisite piece of criticism (an expansion of an article in an early number of this Journal) is well worthy of separate publication. On our once expressing to Lord Jeffrey a wish to see it in such a form, he said that he could have no objection, if the proprietors of the Encyclopædia had none. As so many of the contributions to that great work have been given to the public in a separate form, it may be hoped that this also will at length be added to the number.

for the approximate uniformity, and the limited diversities of taste in mankind at large.

But whatever he means, or does not mean, it is impossible, here or elsewhere, to withhold our admiration of the manner in which the author has illustrated and adorned his theme, and of the many original and beautiful reflections which are interspersed amidst some rather questionable speculations.

We have left ourselves no space for extracts from the Lectures on the Beautiful; but we cannot help extracting the following brief paragraphs on the effect of custom and proportion in modifying our idea of beauty:—

But in order to show the effect of custom upon the beautiful, take a chin, which is of no use at all. A chin ending in a very sharp angle, would be perfect deformity. A man whose chin terminated in a point, would be under the immediate necessity of retiring to America; he would be a perfect horror; and for no other reason that I can possibly see, but that nature has shown no intention of making such a chin—we have never been accustomed to see such chins. Nature, we are quite certain, did not intend that the chin should be brought to a perfect angle, nor that it should be perfectly circular, and therefore either of these extremes is a deformity. Now, something considerably removed from the perfect circle and the perfect angle, is the chin we have been most accustomed to see, and which, for that reason, we most approve of. (P. 187.)

Mr. Burke contends, and in my humble opinion with great success, that proportion is never of *itself* the original cause of beauty. It is the cause of beauty, as it is an indication of strength and utility in buildings—of swiftness in animals—of any feeling morally beautiful; and it is agreeable, as it is customary, in animals, or the proof of the absence of deformity; but no proportion of itself, and without one of these reasons, ever pleases. No man would contend nature ever intended that 6 to 2, or 9 to 14, are perfection; that the moment a monkey could be discovered and brought to light, the length of whose ear was precisely the cube root of the length of his tail, that he ought to be set up as a model of perfect conformation to the whole simious tribe. Certain proportions are beautiful, as they indicate skill, swiftness, convenience, strength, or historical association; and then philosophers copy these proportions, and determine that they must be originally and abstractedly beautiful—applying that to the sign, which is only true of the thing indicated by the sign. (P. 180.)

Two of the best lectures in the volume are those entitled, "Faculties of Animals and Men," and "Faculties of Beasts." If one had picked up this portion of the manuscript by the road-side, one could have sworn to its authorship. How characteristic is the opening paragraph:—

I confess I treat on this subject with some degree of apprehension and reluctance; because I should be very sorry to do injustice to the poor brutes, who have no professors to revenge their cause by lecturing on *our* faculties; and at the same time I know there is a very strong anthropical party, who view all eulogiums on the brute creation with a very considerable degree of suspicion; and look upon every compliment which is paid to the ape, as high treason to the dignity of man.

There may, perhaps, be more of rashness and ill-fated security in my opinion, than of magnanimity or liberality; but I confess I feel myself so much at my ease about the superiority of mankind—I have such a marked and decided contempt for the understanding of every baboon I have yet seen—I feel so sure that the blue ape without a tail will never rival us in poetry, painting, and music—that I see no reason whatever why justice may not be done to the few fragments of soul, and tatters of understanding, which they may really possess. I have sometimes, perhaps, felt a little uneasy at Exeter 'Change, from contrasting the monkeys with the prentice boys who are teazing them; but a few pages of Locke, or a few lines of Milton, have always restored me to tranquillity, and convinced me that the superiority of man had nothing to fear. (P. 238.)

In an enumeration of the causes of man's superiority to the lower animals there occur the following singular yet apposite illustrations:—

His gregarious nature is another cause of man's superiority over all other animals. A lion lies under a hole in a rock; and if any other lion happens to pass by they fight. Now, whoever gets a habit of lying under a hole in a rock, and fighting with every gentleman who passes near him, cannot possibly make any progress. Every man's understanding and acquirements, how great and extensive soever they may appear, are made up from the contributions of his friends and companions. * * *

If lions would consort together, and growl out the observations they have made, about killing sheep and shepherds, the most likely places for catching a calf grazing, and so forth, they could not fail to improve; because they would be actuated by such a wide range of observation, and operating by the joint force of so many minds. * * * A third method in which man gains the dominion over other animals, is, by the structure of his body, and the mechanism of his hands. Suppose, with all our understanding, it had pleased Providence to make us like lobsters, or to imprison us in shells like cray-fish, I very much question if the monkeys would not have converted us into sauce; nor can I conceive any possible method by which such a fate could have been averted. Suppose man, with the same faculties, the same body, and the hands and feet of an ox—what then would have been his fate? (Pp. 267, 268.)

The fact seems to be, that though almost every quality of mind we possess can be traced in some trifling degree in brutes; yet *that* degree, compared with the extent in which the same quality is observable in man, is very low and inconsiderable. For instance, we cannot say that animals are devoid of curiosity, but they have a very slight degree of curiosity; they imitate, but they imitate very slightly in comparison with men; they cannot imitate anything very difficult; and many of them hardly imitate at all; they abstract, but they cannot make such compound abstractions as men do; they have no such compounded abstractions as city, prudence, fortitude, parliament, and justice: they reason, but their reasonings are very short, and very obvious: they invent, but their inventions are extremely easy, and not above the reach of a human idiot. The story I quoted from Bailly, about the ape and the walnuts, is one of the most extraordinary I ever

read; what a wretched limit of intellect does it imply to be cited as an instance of extraordinary sagacity! (P. 270.)

The whole of this interesting subject is treated with great power. Instinct—its nature and limits—its resemblances and dissimilarities to reason—the "vain philosophies" which would exalt brutes to men, or degrade men to brutes, or degrade brutes below themselves—even into mere machines—are discussed in the spirit of true philosophy, and with the vivacity of genuine wit. Maintaining the just prerogatives of the "sovereign of this lower world," our author yet defends the claims of the subject brutes with an impartiality which may make the "lion" cease to regret that his race have no "painters."

In conclusion; though some may probably deem that this volume contains too much merriment for so grave a theme, and that philosophy is here masquerading it a little too lightly for her character—the fault, if fault it may be, may well be pardoned. It is rarely indeed that metaphysics have so transgressed. For one vessel (laden with a similar cargo) that rides too high in the water for want of ballast, there are a hundred whose weight sinks them to the water's edge, and thousands whose too ponderous freight has sent them to the bottom, before they were fairly afloat. It is, in our judgment, a recommendation of these lectures that they may induce some to read about Mental Philosophy who would otherwise have never read about it at all. He who cannot bear philosophy except in conjunction with a congenial gravity can find plenty of works to his mind.

From the Spectator.

PARLIAMENTARY PUBLICATIONS.

Fifteenth Report of the Inspectors of Prisons. II. Northern and Eastern District. IV. Scotland. (Presented by command.)

By a recent arrangement, Mr Frederick Hill has been placed in charge of a district which comprises eight of the Northern and Eastern counties; and his report contains the result of a personal inspection of all the prisons contained in the circuit.

The same story has to be told: nothing which concerns the reformatory process is satisfactory. Mr. Hill recommends the establishment of District Agricultural Prisons; and so far as this goes it is not unlikely that Mr. Charles Pearson may claim him as a coadjutor. The cry raised against prison-labor entering into competition with "honest" labor in the common market, has led to the suspension of some handicrafts which used to be carried on in prisons; and difficulty is experienced in finding substitutes. Mr. Hill objects to the treadwheel, on several grounds; in fact, few of the modes by which direct punishment is inflicted upon prisoners meets with his approbation. With improvement in trade, a diminution in the number of offenders has been experienced.

Mr. John Kincaid is the reporter for Scotland. He is unable to note any diminution in the number of convictions, but mentions that graver offences have become fewer. He recommends a trial of Jebb's "crank machine" as a means of rendering imprisonment in a gaol less attractive than it appears to be at present.

Return of the number of Interments in the Vaults and Churchyard of St. Margaret's, Westminster, for each year since 1839. (Lord Dudley Stuart.)

From proximity, members of Parliament, when in session, are exceedingly sensitive as to what is going on under-ground in the church and churchyard of St. Margaret's. This return may tend in some degree to quiet apprehension. In 1848, the number of interments in the vaults was 5; in 1849, there were none. In the churchyard, the interments have diminished from 150 in 1841, to 50 in 1849.

Return of the Net Produce of the Duty on Game Certificates and Licences, for the five years ending April, 1849. (Colonel Kemeys Tynte.)

The year 1847–8 was the best of the group; 145,327*l.* having been received from all sources. For the year 1848–9, the amount was 126,882*l.*

Return of all Moneys Lent to Railway Companies in Ireland, and the amount Repaid, &c. (Sir Robert Ferguson.)

The advances are—to the Dublin and Drogheda, 156,000*l.*; the Great Southern and Western, 495,000*l.*; the Waterford and Kilkenny, 83,000*l.*; the Midland Great Western, 100,000*l.* The rate of interest on the first three advances is 5 per cent.; on the last it is 3½ per cent. The companies are honorably fulfilling their engagements both as regards the payment of interest and the instalments.

Union Financial Statement of the Irish Poor-law for December, 1849. (Presented by command.)

A diminution in the expense, a large reduction in the amount of out-door relief, and less mortality, continue to be the results as compared with the corresponding month of 1848.

A tabular Statement, showing the Meetings held by the Governors of Queen Anne's Bounty, and the Attendance of each Governor, from 1836 *to the present time; also of all Committee Meetings, and the Names of the Governors attending them; also of the Board of Commissioners appointed to carry into effect the Church-building Acts.* (Mr. Horsman.)

This document consists of fifteen pages of tabular printing; and the object is to show who the parties were who made conscience of attending the meetings, and who did not. The late Archbishop of Canterbury and the present Bishop of London appear to have been the most exemplary of the prelates.

Returns of the number of Corps of Yeomanry in Great Britain, in each year, from 1843 *to* 1849. (Mr. Miles.)

In 1844, the number of troops was 258, and of men 15,583; in 1849, the numbers were 251 troops and 15,358 men. In the interim, the quotas of Lincoln, Surrey, and Sussex, were discontinued. The numbers which have annually turned out for training and permanent duty are considerable enough to show that the farming class are as fond of soldiery pursuits and amusements as ever.

List of the principal Manufactured Articles imported on which a Duty of Customs is imposed; the Rate and Amount of Duty in 1849; *and return of Agricultural Produce imported, and Duty thereon.* (Mr. Hume.)

This return is intended to afford a ready answer to the Protectionist complaint that while manufactures are "protected," agricultural produce is not. Dropping minor articles, the enumeration of which tends to confuse, the principal description of manufactures and produce are selected from the tariff, and the amount of import-duty to which they are still subjected is stated. As regards the amount of duty realized from both branches in the year ending 5th of January, 1850, the estimate is—from foreign manufactures, 476,486*l.*; from foreign produce, 1,062,506*l.* It may be remarked that 540,691*l.* was received from the one shilling duty per quarter on wheat and other cereals; 77,123*l.* was derived from the meal-duty of 4½*d.* per cwt. Butter, cheese, clover-seed, and tallow, were also prolific in revenue. Of eggs, 97,884,557 were imported; and the duty amounted to 35,694*l.*

Papers respecting the Cession to the British Crown of the Danish Possessions on the Coast of Africa. (Presented in pursuance of address.)

This publication is intended to clear the way for the House of Commons being asked to vote 10,000*l.*, price agreed to be paid for the session of certain forts, with their munitions of war, belonging to Denmark, but situated on the coast of Guinea. The offer of sale appears to have come spontaneously from the Danish government; and the reasons assigned are altogether philanthropic—namely, that as the forts border on the English possessions in that region, England would be able to turn them to good account in promoting civilization, discouraging the slave-trade, and developing the commercial resources of the district. The offer was at once accepted by the English government, under the condition that should the money not be voted by Parliament the bargain is not to hold.

Copies or Extracts of any Despatches relating to the Suppression of Piracy off the coast of Borneo. (Mr. Hume.)

These papers are explanatory of the reasons which induced Sir James Brook to request the aid of the naval force stationed in the Indian seas to suppress the extensive and audacious system of piracy carried on in the vicinity of Sarawak. Commander Farquhar narrates the proceedings of the expedition which intercepted (on the 31st July, 1849) the pirates as they were approaching the Sarebas river, after a cruise, and which was successful enough in the way of destruction. Rajah Brook recommends the erection of a fort or two on eligible positions for cutting off the communication of the pirates with the sea.

Copies of Despatches from India respecting the Claims of Chrishna Rao Withul, &c. (Lord Dudley Stuart.)

The details acquire some interest from the circumstance of a notice having been given in the House of Commons by Lord Dudley Stuart of his intention to move for a Select Committee to inquire into the claims of Chrishna Rao Withul. This Hindoo gentleman is the adopted son of the late Wittul Row, who acted as minister to the ruler of Baroda; and the question at issue relates to the liability of the Indian government to make good certain annual payments which were conferred upon Wittul Row in perpetuity by the native prince, and which are alleged to have been "guaranteed" by a responsible officer of the company, or to compel the prince to make good his engagements. The directors decline to adopt either alternative; but, in consideration of the devotion of the late Wittul Row to British interests, they authorize an annual allowance of 24,000 rupees to be paid to his adopted son. Chrishna, however, insists for his "bond."

Accounts relating to Hops and Malt, &c. (Mr. Alderman Humphrey.)

It appears from this return that the hop-growing interest does not extend beyond 42,798 acres; that being the space under cultivation in England. The duty on the growth of 1849 yielded 145,693*l.* The quantity exported amounted to 274,811 pounds; and imported to 5,271 hundred weight.

Return of Corn and Meal Importations for the year ending the 5th of January, 1850, *stated monthly; the average price of the year; the average price at which the rent-charge in lieu of Tithes is taken for the year.* (Mr. William Miles.)

The moral lies in the average price for the year, as compared with the rent-charge payable in lieu of tithes; and the object of the return is, no doubt, to prove helpful in bringing about a reädjustment of the ecclesiastical charge. As the point will ere long be mooted in Parliament, the following materials for contrast may be presented.

	Wheat.	Barley.	Oats.
Average Price of the year 1849, . .	44*s.* 3*d.*	27*s.* 9*d.*	17*s.* 6*d.*
Tithe Rent-charge: average of seven years, ...	53*s.*	32*s.* 10*d.*	21*s.* 8*d.*

Return of the Mortality from Disease among the European Troops in the East and West Indies, from 1840 *to* 1848. (Sir Thomas Acland.)

The ratios are exceedingly variable. Thus, in 1842, the mortality in the East Indies is nearly 10 per cent., while in the West Indies it is only 4½. In 1848, the tables are turned, for the mortality in the East is scarcely 4 per cent., while in the West it exceeds 5½.

From the Dublin Univ. Mag.

WRITTEN AFTER VISITING EXETER CATHEDRAL.

THERE were pale figures of our ancient kings,
And sculptured knights and warriors were there,
And sainted priests in attitude of prayer;
But dim and dreary seemed the hallowed things
Of that august cathedral, as they lay
In twilight—till the painted window's ray,
Like sunset tints mixed with the rainbow's hue,
Shed o'er the antique figures in my view
A living splendor. So we see the light
Of many-colored genius, brightly cast,
Over high thoughts and warrior actions past;
Making them flash before the mental sight,
With an undying radiance, as we read
Thy glorious page—High Minstrel of the Tweed!

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PROSPECTUS.—This work is conducted in the spirit of Littell's Museum of Foreign Literature, (which was favorably received by the public for twenty years,) but as it is twice as large, and appears so often, we not only give spirit and freshness to it by many things which were excluded by a month's delay, but while thus extending our scope and gathering a greater and more attractive variety, are able so to increase the solid and substantial part of our literary, historical, and political harvest, as fully to satisfy the wants of the American reader.

The elaborate and stately Essays of the *Edinburgh*, *Quarterly*, and other Reviews; and *Blackwood's* noble criticisms on Poetry, his keen political Commentaries, highly wrought Tales, and vivid descriptions of rural and mountain Scenery; and the contributions to Literature, History, and Common Life, by the sagacious *Spectator*, the sparkling *Examiner*, the judicious *Athenæum*, the busy and industrious *Literary Gazette*, the sensible and comprehensive *Britannia*, the sober and respectable *Christian Observer*; these are intermixed with the Military and Naval reminiscences of the *United Service*, and with the best articles of the *Dublin University*, *New Monthly*, *Fraser's*, *Tait's*, *Ainsworth's*, *Hood's*, and *Sporting Magazines*, and of *Chambers'* admirable *Journal*. We do not consider it beneath our dignity to borrow wit and wisdom from *Punch*; and, when we think it good enough, make use of the thunder of *The Times*. We shall increase our variety by importations from the continent of Europe, and from the new growth of the British colonies.

The steamship has brought Europe, Asia, and Africa, into our neighborhood; and will greatly multiply our connections, as Merchants, Travellers, and Politicians, with all parts of the world; so that much more than ever it now becomes every intelligent American to be informed of the condition and changes of foreign countries. And this not only because of their nearer connection with ourselves, but because the nations seem to be hastening, through a rapid process of change, to some new state of things, which the merely political prophet cannot compute or foresee.

Geographical Discoveries, the progress of Colonization, (which is extending over the whole world,) and Voyages and Travels, will be favorite matter for our selections; and, in general, we shall systematically and very fully acquaint our readers with the great department of Foreign affairs, without entirely neglecting our own.

While we aspire to make the *Living Age* desirable to all who wish to keep themselves informed of the rapid progress of *the movement*—to Statesmen, Divines, Lawyers, and Physicians—to men of business and men of leisure—it is still a stronger object to make it attractive and useful to their Wives and Children. We believe that we can thus do some good in our day and generation; and hope to make the work indispensable in every well-informed family. We say *indispensable*, because in this day of cheap literature it is not possible to guard against the influx of what is bad in taste and vicious in morals, in any other way than by furnishing a sufficient supply of a healthy character. The mental and moral appetite *must* be gratified.

We hope that, by "*winnowing the wheat from the chaff*," by providing abundantly for the imagination, and by a large collection of Biography, Voyages, and Travels, History, and more solid matter, we may produce a work which shall be popular, while at the same time it will aspire to raise the standard of public taste.

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A newspaper is "any printed publication, issued in numbers, consisting of not more than two sheets, and published at short, stated intervals of not more than one month, conveying intelligence of passing events."

Monthly parts.—For such as prefer it in that form, the Living Age is put up in monthly parts, containing four or five weekly numbers. In this shape it shows to great advantage in comparison with other works, containing in *each part* double the matter of any of the quarterlies. But we recommend the weekly numbers as fresher and fuller of life. Postage on the monthly parts is about 14 cents. The *volumes* are published quarterly, each volume containing as much matter as a quarterly review gives in eighteen months.

E. LITTELL & CO., BOSTON.

WASHINGTON, 27 Dec. 1845.

Of all the Periodical Journals devoted to literature and science which abound in Europe and in this country, this has appeared to me the most useful. It contains indeed the exposition only of the current literature of the English language, but this, by its immense extent and comprehension, includes a portraiture of the human mind in the utmost expansion of the present age.

J. Q. ADAMS.